JOURNAL OF DAIRY SCIENCE

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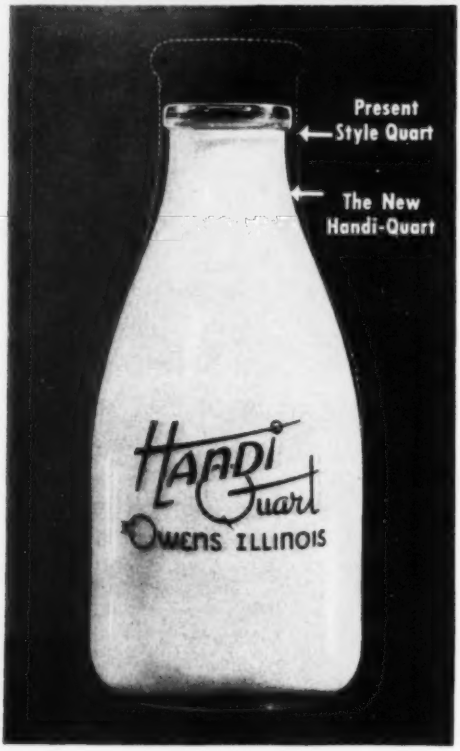
Vol. XXIV, No. 6, June, 1941

Published by the
AMERICAN DAIRY SCIENCE ASSOCIATION

Milk—all liquid, even molten glass—when poured forms a "teardrop." That's Nature's way of evenly distributing liquid mass, of insuring best distribution of thickness and weight.

Here's the New . . .

OWENS-ILLINOIS Handi-Quart



The new O-I Handi-Quart is a natural "teardrop," modified to traditional milk bottle shape. Its distribution of glass in neck, shoulders and sidewalls, plus exclusive bridge-truss bottom construction, makes it milk's most modern, low-weight, streamlined *Salespackage.* Available either as private mold or with applied color lettering; also in pints and half-pints. The O-I Handi-Quart brings these distinct advantages.

FOR THE CONSUMER

1. *Easy to handle*
2. *Easy to pour from*
3. *Space-saver in refrigerator*

FOR DAIRYMEN

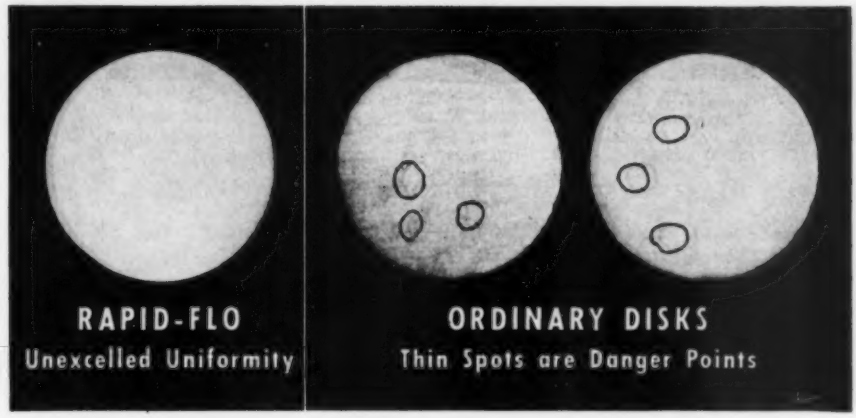
1. *A distinct "merchandising" package*
2. *Substantially lower bottle cost*
3. *Maximum capping economy*
4. *Minimum operating change to use it*
5. *Savings in handling and load-weight*
6. *A "natural" for store trade*

OWENS ILLINOIS

Complete Dairy Service

WHERE QUALITY PREDOMINATES

A FILTER DISK *is no stronger* THAN ITS WEAKEST CHINK!



● Our attention has been called to the prevalence of thin spots in some ordinary filter disks. This probably accounts for their failure to filter milk so as to show satisfactory sediment tests under today's rigid regulations. These thin spots naturally offer less resistance; more milk goes through them and very soon there is likely to be a hole that allows sediment to pass.

MAKE THIS SIMPLE TEST

A simple test for thin spots is to lay disks on a dark surface. Rapid-Flo is one of the very few filter disks which can successfully meet this simple test.

Rapid-Flo's controlled manufacturing process gives unexcelled uniformity, an assurance of consistently efficient filtration.

RAPID-FLO
FILTER DISKS
Johnson & Johnson
NEW BRUNSWICK, N. J. CHICAGO, ILL.

JOURNAL OF DAIRY SCIENCE

OFFICIAL ORGAN OF
AMERICAN DAIRY SCIENCE ASSOCIATION
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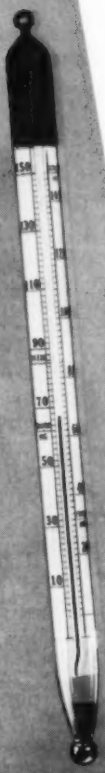
For Assurance

DAIRY GLASSWARE

FLOATING THERMOMETERS

Kimble Floating Thermometers Nos. 660 and 663, illustrated here, are equipped with a "safety glass" feature—a *tough, transparent COATING* which greatly increases resistance to breakage if accidentally dropped or struck. This protective coating retains fragments of glass and mercury, avoiding contamination of milk. Immune to the action of hot milk, the safety coating does not affect the taste or qualities, and will not crack or turn yellow.

These Thermometers, with No. 665 listed below, are also provided with *orange-backed* thermometer tubing to set off the mercury column in bold relief, thereby affording greater ease and accuracy of reading.



No. 660

SPECIFICATIONS AND PRICES

No. 660—FLOATING CHURN THERMOMETERS with transparent coating and orange-backed thermometer tubing. Range 0° to 160°F., in 2° divisions. Accurate to within 1°. Mercury-filled, shot-weighted.

Each $.80 **Dozen $8.00** **6 Dozen $40.00**

No. 663—FLOATING PASTEURIZING THERMOMETERS with transparent coating and orange-backed thermometer tubing. Range 0° to 220°F., in 2° divisions. Accurate to within 1°F. Mercury-filled, shot-weighted.

Each $.80 **Dozen $8.00** **Gross $80.00**

No. 665—FLOATING PASTEURIZING THERMOMETERS (similar to No. 663) with orange-backed tubing but without transparent coating. Range 0° to 220°F., in 2° divisions. Accurate to within 1°. Mercury-filled, shot-weighted.

Each $.68 **Dozen $6.80** **Gross $68.00**

Ask your jobber to supply Kimble Brand RETESTED Floating Thermometers on your next order.

No. 663

K KIMBLE GLASS

• • • *The Visible Guarantee of Invisible Quality* • • •

KIMBLE GLASS COMPANY • • • • VINELAND, N. J.

To Insure a Better Product—

USE A DE LAVAL "AIR-TIGHT" CLARIFIER to Remove Sediment

OUTSTANDING milk plants and condensaries in all parts of the country have installed the De Laval "Air-Tight" Milk Clarifier for a single basic reason: *to insure a better product.* But in doing so, they have attained other almost equally important objectives, chief among which in many cases is lower operating costs.

The ability of the centrifugal clarifier to more completely remove sediment from milk is never seriously questioned. Tests have repeatedly shown that clarification removes several times as much sediment from the same milk as can be removed by other processes.

Then, too, the "Air-Tight" Clarifier is completely adaptable to every conceivable milk plant layout and condition. It is a completely enclosed unit, receiving and discharging milk under pressure; the same pump which feeds the clarifier furnishes pressure to elevate the milk after clarification, pass it through heaters, coolers, etc.

In addition to its ordinary advantages in improving the product and lowering sediment removal cost in connection with regular bottling plant and condensary service, the "Air-Tight" Clarifier might be termed "must" equipment at plants in which short-time, high-temperature pasteurizing systems have been installed and in the production of homogenized milk where sediment-free milk is essential.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC COMPANY, 61 Beal St., San Francisco
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

POSITIVE • SANITARY • ECONOMICAL

DE LAVAL "AIR-TIGHT" MILK CLARIFIER

Your advertisement is being read in every State and in 25 Foreign Countries

In LIFE
SATURDAY EVENING POST
COLLIERS AND FORTUNE. . .

36,000,000 alert Americans read the facts about Dextrose

And those facts influence the consumer to ask for ice creams which use Dextrose in their preparation.

MR. ICE CREAM MANUFACTURER: Are you using Cerelose (pure Dextrose sugar) in your formulas? Manufacturers now using Dextrose are convinced that Dextrose enchances flavor, improves texture and develops finer eating qualities of ice creams and ices. For further information including expert technical advice . . . without cost or obligation . . . please write . . .

CORN PRODUCTS SALES CO.
17 Battery Place, New York

Makers of

CERELOSE

PURE DEXTROSE SUGAR

. . . IT'S *Proved* BY SCIENTIFIC TEST FOR ALL DAIRY MACHINE BOTTLE WASHING

PERFORMANCE TESTS OF ANCHOR ALKALI PROVE:

1 **COMPLETE AND RAPID SOLUBILITY**—You get full cleansing value from Anchor Alkali. Tests prove that it dissolves completely—and at least 1/3 faster than older types of alkalies.

2 **DETERGENT EFFICIENCY**—Comparative tests show that Solvay Anchor Alkali produces bright, clean bottles from the start of cleaning operation. It is noticeably better in this respect than other cleansers tried.

3 **STERILIZATION**—The use of Anchor Alkali produces low bacteria count.

4 **SCALE PREVENTION**—Tests prove that in some waters Solvay Anchor Alkali removes scale from bottle washing machines. Under any water condition, its use will result in less deposition than most other alkalies.

5 **LUBRICATION**—Solvay Anchor Alkali has been proven by test to be a superior lubricant for moving parts of the washer.

6 **LOW ALKALI CONSUMPTION**—Less (by test) Anchor Alkali is required to wash a given number of bottles in standard equipment in both hard and soft waters.

7 **UNIFORMITY**—Solvay Anchor Alkali is a dustless product made in flake form. Tests prove that each flake carries the proper ratio of cleansing elements.

SEND IN COUPON TODAY for complete folder which tells you how Anchor Alkali is used.

SOLVAY SALES CORPORATION
40 Rector Street, New York, N. Y.

Gentlemen: Kindly send me your complete folder describing Anchor Alkali for use in the dairy.

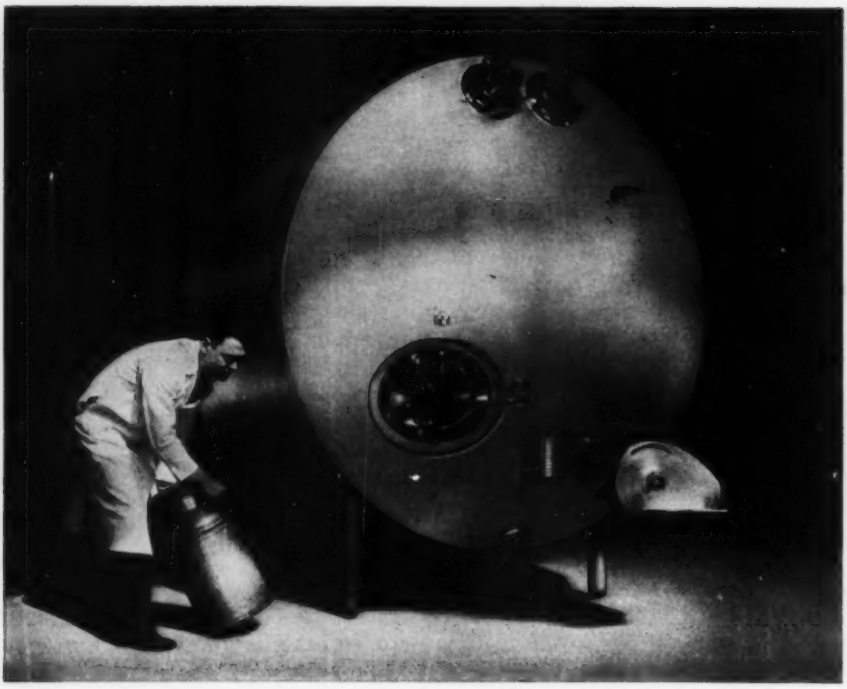
Name .....

Associated with .....

Address .....

City ..... *State* CX-641

Your advertisement is being read in every State and in 25 Foreign Countries



ARE YOU UP-TO-DATE ON THE *LATEST* MILK STORAGE TANK DEVELOPMENTS

There's news about Glass-Lined and Stainless Steel Milk Storage Tanks and it's just out in the new Pfaudler Bulletin No. 606. In it, we demonstrate how Pfaudler Engineers have streamlined storage tank sanitation for quickest cleaning.

We suggest that you send right now for your copy and then compare these storage units point for point with any on the market today. Then, and only then, will you appreciate the full value of Pfaudler design:

1. *All* Pfaudler Milk Storage Tanks are built with deep dished heads with large knuckle radius—sounder and more sanitary construction.
2. All fittings are of "hook type," quick and easy to remove from the tank opening. They can be taken apart in a matter of seconds.
3. A new sanitary motor drive with detachable agitator shaft simplifies cleaning and meets exacting requirements.
4. The sanitary one-piece rotary seal for the agitator is the last word in sanitary engineering.
5. All Pfaudler Milk Storage Tanks are built to meet varying pressure requirements.

These are just a few of the highlights of the newest Bulletin No. 606. Your copy awaits your written request.

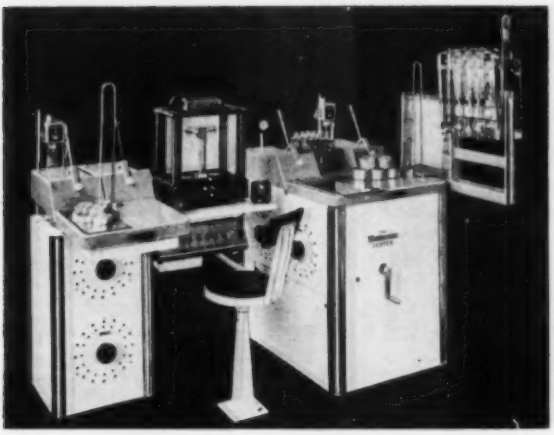
THE PFAUDLER CO.,
Executive Offices: Rochester, N. Y.

Please send me Bulletin No. 606
Name .....
Company .....
Address .....

PFAUDLER

Your advertisement is being read in every State and in 25 Foreign Countries

SPEEDY AND ACCURATE SCIENTIFIC TESTING



The need for both speed and accuracy in the testing of dairy products to meet competitive conditions and to insure uniformity has never been more insistent than at the present time. Both speed and accuracy are now of first importance when dealing with products that are at once readily perishable and of large commercial and economic value.

On the Mojonnier Tester both butter fat and total solids tests can be made simultaneously in *thirty minutes.*

Write *today* for full details.

Mojonnier TESTER

MOJONNIER BROS. CO.
4601 W. OHIO ST., CHICAGO, ILL.

YOU CAN DEPEND UPON

The reliable, effective, easy-to-use, inexpensive bactericide

B-K Powder is a hypochlorite bactericide. It is quick and effective because it contains 50% available chlorine. The reliability of B-K has been recognized for a quarter of a century in Public Health services, the dairy field, dispensing equipment use, etc.

B-K is easy to use. It is effective in hot or cold water. B-K offers faster, more certain results than steam or hot water as ordinarily used.

B-K is very inexpensive. 250 gallons of 100 ppm quick-acting, chlorine-rinsing B-K solution costs as low as 25c!

APPROVED BY HEALTH AUTHORITIES

You will find our free booklet "Sanitizing Local Water Supplies" interesting and informative. We shall be glad to send you a copy, FREE, and help you with any special disinfecting problems you may have.

USE COUPON FOR FREE SAMPLE

GENERAL LABORATORIES DIVISION,
Pennsylvania Salt Mfg. Co., Dept. DS
Widener Bldg., Philadelphia, Pa.

Gentlemen:

You may send, without charge or obligation, copy of your booklet "Sanitizing Local Water Supplies" and a sample bottle of your B-K Powder.

NAME _____

ADDRESS _____

CITY & STATE _____

Your advertisement is being read in every State and in 25 Foreign Countries

Concerning The Use Of

FRO-DEX*

(corn syrup solids)

IN ICE CREAM

Fro-dex was originally conceived and developed specifically for use in ice cream, sherbets, and water ices. The widespread adoption of this product as "the preferred sweetening agent" by leading ice cream manufacturers throughout the country has well demonstrated that FRO–DEX in combination with sucrose produces superior results.

Definition

Fro-dex (corn syrup solids) is composed of dextrose, maltose, and edible dextrins (pro-sugars).

Easier Freezing

As Fro-dex has a higher molecular weight than other known sweetening agents, ice cream mix containing Fro-dex has a higher freezing-point, making the mix easier to freeze.

Smoother Body and Texture

Because ice cream mix containing Fro-dex freezes more easily and therefore more quickly, the ice crystals are smaller, resulting in an ice cream of smoother body and texture. Likewise, extensive tests have been carried out comparing ice creams made with combinations of Fro-dex and sucrose with ice creams made with other sweetening agents. In every instance the ice creams containing the Fro-dex and sucrose maintained the smooth body and texture over a longer period of time.

Increased Solids

Because the ice cream manufacturer can with a combination of sweetening agents adjust his mix, it is possible for him to safely and economically increase the total solids of his product with Fro-dex.

We shall be very glad to send you additional information or recommendations concerning the use of Fro-dex in the Ice Cream Industry. Kindly address our Technical Service Division.

*Reg. U. S. Pat. Off.

AMAIZO

Packed in 100 lb. Bags

AMERICAN MAIZE-PRODUCTS COMPANY

100 EAST FORTY-SECOND STREET NEW YORK, N. Y.

Your advertisement is being read in every State and in 25 Foreign Countries

The ARISTOCRAT of PASTEURIZERS

In certain areas, open heaters are compulsory. Illustration shows the PURITY SENIOR equipped with open heater built in accordance with U.S.P.H.S. milk ordinance and code, and certain modifications to meet specific board of health requirements.

THE O. & B. PURITY SENIOR is built throughout along lines which are truly Aristocratic and DeLuxe.

Possessing every advantage and operating feature of our Sixtieth Anniversary Model, it is also much more solidly built, being constructed in every respect of heavier materials. It is an exceptionally handsome machine; and the most up-to-the-minute milk man could ask for nothing finer or more durable. It is the installation "par excellence" for the "show plant." Completely encased in polished stainless steel.

Insulated with an inch of pure corkboard, it is equally desirable with either milk, cream, or ice cream mix. Very fast heating, and produces a deep cream line, with fine flavor. The inner vat is of ground and polished stainless steel, ¼ inch thick, and is entirely surrounded on sides and bottom with hot water. It is therefore a very fast machine. This prevents off-flavor and burning on.

Solid 1-piece welded breast. Brass pipe, and bronze heater-circulators of our own design. A new feature is the handsome pitched cover and an instantly demountable hinge which permits both halves of the cover to be lifted off independently and instantly. Agitator is direct connected to splash-proof motor with reduction gears integral.

Sectional view of the PURITY SENIOR, showing the powerful yet gentle inclined-blade propeller type agitator; also construction of inner and outer shell, and the water chamber.

We manufacture complete lines of Pasteurizers, both Round and Rectangular. We have or can promptly fabricate just what you need. You'll be glad you bought a PURITY

OAKES & BURGER CO.
Factory & Offices - CATTARAUGUS, NEW YORK
Branch . . . . YOUNGSTOWN, OHIO, U.S.A.

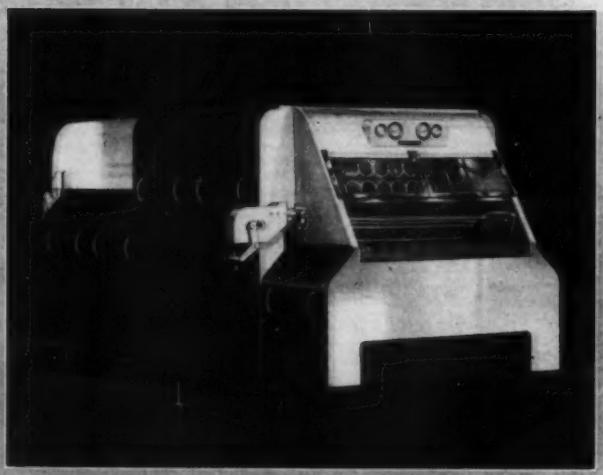
Established 1873 · Nearly Seventy Years of Honest Equipment

Your advertisement is being read in every State and in 25 Foreign Countries

CHERRY-BURRELL'S NEW Model E BOTTLE WASHER

Handles 2 Qt. Bottles

An even greater washer than the Model "C" . . . handles all size bottles from ½ pt. to 2 qt., without adjustment . . . fourteen bottle treatments . . . high, uniform soaking temperature . . . remarkably fine washing performance . . . little bottle damage, less water, less washing powder . . . exceptionally rugged . . . fully enclosed yet instantly accessible . . . 4, 6, 8, 10 and 12-wide sizes . . . capacities from 24 to 110 bottles a minute . . . described and illustrated in new colorful Bulletin G-387.



A POSTCARD BRINGS YOU BULLETIN G-387, AND INFORMATION ON THE MODEL E MOVIE WHICH IS SOON TO BE RELEASED

CHERRY-BURRELL CORPORATION • 427 W. Randolph St., CHICAGO

Your advertisement is being read in every State and in 25 Foreign Countries

JOURNAL OF DAIRY SCIENCE

VOLUME XXIV JUNE, 1941 NUMBER 6

PROGRAM

THIRTY-SIXTH ANNUAL MEETING

OF THE

AMERICAN DAIRY SCIENCE ASSOCIATION

UNIVERSITY OF VERMONT
BURLINGTON, VERMONT
JUNE 23–26, 1941

PROGRAM COMMITTEE

EXTENSION
- GLEN W. VERGERONT, Wisconsin (*Chairman*)
- J. F. KENDRICK, Bureau of Dairy Industry
- E. H. LOVELAND, Vermont

MANUFACTURING
- W. V. PRICE, Wisconsin (*Chairman*)
- E. H. PARFITT, Evaporated Milk Association
- PAUL F. SHARP, New York

PRODUCTION
- W. E. PETERSEN, Minnesota (*Chairman*)
- K. S. MORROW, New Hampshire
- A. H. KUHLMAN, Oklahoma

GENERAL
- E. S. GUTHRIE, New York (*Chairman*)
- GLEN W. VERGERONT, Wisconsin
- W. V. PRICE, Wisconsin
- W. E. PETERSEN, Minnesota

SCHEDULE OF PROGRAM

Time	General	Extension Section	Production Section	Manufacturing Section
Mon., June 23				
9: 00– 3: 00	Committees	Committees	Committees	Committees
9: 00 ——	Directors			
2: 00– 4: 00				Judging
3: 00– 5: 00			Tour—barns and herds	
Evening 7: 30	Get-together			
Tues., June 24				
9: 30–11: 00	Opening session			
11: 00–12: 00	Committees	Committees	Committees	Committees
12: 00– 1: 30		Lunch	Lunch	Lunch
1: 30– 3: 30		Papers	Papers—Div. A B	Symposium—Properties and utilization of cream
3: 30– 4: 30		Business	Business	Business
Evening 8: 00	Reception			
Wed., June 25				
9: 00–11: 00		Symposium—Mastitis		Papers—Div. A B
11: 00–12: 00	Committees			Committees
12: 00– 1: 30	Picture 12: 00 Barbecue 12: 15			
1: 30– 3: 30		Papers and Panel	Papers—Div. A B	Symposium—Milk pasteurization
3: 30– 4: 30			Business	Business
Evening 6: 00	Boat ride Buffet supper			
Thur., June 26				
9: 00–11: 00		Symposium and Papers	Symposium	Papers—Div. A B
11: 00–12: 00			Business	Business
12: 00– 1: 30		Lunch	Lunch	Lunch
1: 30– 3: 30		Papers Reports	Symposium—Curricula	
3: 30– 5: 00	Business			
Evening 7: 00	Banquet			

REGISTRATION

Room 4-South, Old College Building

Sunday	2:00 p.m.– 9:00 p.m.
Monday	8:00 a.m.– 9:00 p.m.
Tuesday	8:00 a.m.– 7:00 p.m.
Wednesday	8:00 a.m.– 5:00 p.m.
Thursday	8:00 a.m.–12:00 m.

TENTATIVE PROGRAM FOR WOMEN

MONDAY, JUNE 23—	2:00 P.M.	Demonstration of the Manufacture of Table Silverware — Fleming Museum.
	7:30 P.M.	Social Get-Together and Complimentary Sugar-on-Snow for Everybody —Gymnasium.
TUESDAY, JUNE 24—	11:00 A.M.	Start from Morrill Hall for Complimentary Luncheon at Mt. Mansfield Hotel on the top of Vermont.
	8:00 P.M.	Reception for Everybody—Southwick Memorial.
WEDNESDAY, JUNE 25—	10:30 A.M.	Art Exhibit Depicting Early Vermont History—Fleming Museum.
	11:45 A.M.	Group Picture—Billings Library.
	12:15 P.M.	Complimentary Barbecue Luncheon for Everybody—Gymnasium.
	2:00 P.M.	Bridge or Visiting and Tea—Southwick Memorial.
	6:00 P.M.	Complimentary Boat Ride for Everybody on Lake Champlain—Steamer Ticonderoga, Foot of King Street. Complimentary Buffet Supper on the Boat.
THURSDAY, JUNE 26—	12:30 P.M.	Start from Morrill Hall for Complimentary Luncheon at Twist O'Hill.
	7:00 P.M.	Association Banquet—Gymnasium.

Guests are particularly invited to attend the opening session of the General Program. They also will be welcome at any of the Section Programs.

FOR THE CHILDREN

Tours, Picnics, Swimming and Other Special Entertainment are being planned for Children.

GENERAL PROGRAM

Monday, June 23

7:30 P.M. Social Get-Together and Complimentary Sugar-on-Snow—Gymnasium.

Tuesday, June 24

9:30–11:00 A.M. Opening Session—Gymnasium.

Call to Order—H. B. Ellenberger, Head, Department of Animal and Dairy Husbandry, University of Vermont.

Address of Welcome—William H. Wills, Governor of Vermont and a trustee of the University of Vermont.

Response and Address—H. W. Cave, President, American Dairy Science Association.

Dairy Production Milestones—W. E. Krauss, Associate in Dairy Nutrition, Ohio Agricultural Experiment Station.

8:00 P.M. Reception—Southwick Memorial.

Wednesday, June 25

12:00 M. Group Picture—Billings Library.

12:15 P.M. Complimentary Barbecue—Gymnasium Annex.

6:00 P.M. Complimentary Boatride on Lake Champlain and Buffet Supper—Dock, Foot of King Street.

Thursday, June 26

3:30–5:00 P.M. Business Session—Auditorium, Fleming Museum.

7:00 P.M. Annual Association Banquet—Presentation of Borden Awards—Gymnasium.

SECTIONAL PROGRAMS

EXTENSION SECTION

June 23–26

Exhibits—Display of Extension Teaching Ideas
Room 1, Morrill Hall

Monday, June 23

3:00–5:00 P.M. Tour Barns and Herds—Start from Morrill Hall

Tuesday, June 24

1:30–3:30 P.M. Room 2, Morrill Hall

E. C. SCHEIDENHELM, *Chairman*

E1—Supervisory standards for state men in charge of D.H.I.A. work. R. G. Connelly and R. W. Dickson, Virginia Polytechnic Institute. 487.*

* Numbers at the end of the title refers to the page number on which the abstract appears.

E2—Revision of D.H.I.A. forms. Jos. B. Parker, Bureau of Dairy Industry, United States Department of Agriculture.

E3—Rules and regulations used in D.H.I.A. work. C. R. Gearhart, Pennsylvania State College.

E4—Survey of modified testing. E. H. Loveland, University of Vermont. 488.

E5—Methods of reporting kinds and quality of feed in D.H.I.A. work. A. J. Cramer, University of Wisconsin. 489.*

E6—New D.H.I.A. conversion factors by breeds. J. F. Kendrick, Bureau of Dairy Industry, United States Department of Agriculture. 490.

E7—Uniform annual reports for artificial breeding associations, including standardized methods of evaluating conception rates. Ralph A. Corbett, University of Maine. 490.

3:30–4:30 P.M. Section Business—Room 2, Morrill Hall

Wednesday, June 25

9:00–12:00 A.M. Auditorium, Fleming Museum

O. J. HILL, *Chairman*

Symposium—Mastitis

Joint session of Extension and Production Sections

New developments in physiology and biochemistry of lactation. W. E. Petersen, University of Minnesota.

Observations in mastitis control problems. George E. Taylor, New Jersey College of Agriculture.

Mastitis a state centralized testing service. C. S. Bryan, R. E. Horwood and J. G. Hays, Michigan State College.

The development and use of the Whiteside test in mastitis control. James S. Murphy, New Jersey Experiment Station.

Panel Discussion

Herd Health Committee Report, Geo. E. Taylor, New Jersey, Discussion Leader; C. G. Bradt, Cornell University; J. G. Hays, Michigan State College; Ramer F. Leighton, University of Minnesota; Claude J. Fawcett, Massachusetts State College; A. I. Mann, University of Connecticut; and James S. Murphy, New Jersey State College.

1:30–4:30 P.M. Room 2, Morrill Hall

C. G. CUSHMAN, *Chairman*

E8—Roughage investigation by the Bureau of Dairy Industry. T. E. Woodward and J. R. Dawson, Bureau of Dairy Industry. 491.

E9—Feeding committee report. C. G. Cushman, Clemson Agr'l College.

E10—4-H Club committee report. H. A. Willman, Cornell University.

* Numbers following the titles refer to the page on which the abstract appears.

Panel Discussion

Effectiveness of roughages upon the economy of milk production. A. C. Baltzer, Michigan State College; Otto J. Hill, State College of Washington; L. A. Higgins, Mississippi A. & M. College; and E. H. Loveland, University of Vermont.

Thursday, June 26

9:00–11:45 A.M. Room 1, Morrill Hall

FLOYD JOHNSON, *Chairman*

Symposium—The display of extension teaching ideas

1. South Dakota—D.H.I.A. production and feed summary.
2. Minnesota—Record of D.H.I.A. identification.
3. Iowa—Visual aids of balancing rations.
4. Wisconsin—Method of scoring fieldmen in permanent record project.
5. Kansas—
6. Tennessee—
7. Mississippi—
8. Texas—
9. New Hampshire—
10. New Jersey—
11. New York—
12. Massachusetts—
13. Connecticut—
14. Vermont—
15. Other states—

E11—A study of the growth of 4-H dairy heifers and the reliability of heart girth measurements as a means of estimating live weight. H. W. Willman and G. W. Salisbury, Cornell University. 492.*

E12—Junior program designed to supplement the general adult dairy quality improvement program. Evert Wallenfeldt, University of Wisconsin. 493.

Thursday, June 26

1:30–3:30 P.M. Room 2, Morrill Hall

O. J. HILL, *Chairman*

Papers and Reports

E13—Milk and cream loss prevention for 4-H Club members. M. L. Flack, University of Nebraska. 495.

E14—Dairy quality improvement program for Wisconsin. Dave Nusbaum, University of Wisconsin. 496.

E15—Methods of combating the stockyard bull racket. Leland Lamb, American Dairy Cattle Club.

* Numbers following the titles refer to the page on which the abstract appears.

E16—Federated Artificial Breeding Association of New York. Stanley J. Brownell, Cornell University.
E17—Quality committee report. T. J. Jensen, Michigan State College.
E18—Testing committee report. C. R. Gearhart, Pennsylvania State College.
E19—Report type classification committee. James W. Linn, Kansas State College.
E20—Sire committee report. E. J. Perry, New Jersey State College.
3:30–5:00 P.M. General Business Meeting—Auditorium, Fleming Museum

PRODUCTION SECTION

Monday, June 23

3:00–5:00 P.M. Tour of Barns and Herds—Leave from Morrill Hall.

Tuesday, June 24

1:30–4:30 P.M. See Divisions A and B.

Wednesday, June 25

9:00–11:00 A.M. Symposium—Mastitis, (See Extension Section), Auditorium, Fleming Museum.
1:30–4:30 P.M. See Divisions A and B.

Thursday, June 26

9:00–11:00 A.M. Auditorium, Fleming Museum

T. E. WOODWARD, *Chairman*

Symposium—Roughages

Making greater use of forage. T. E. Woodward, U. S. Bureau of Dairy Industry. (discussion)
The economics of grassland farming. C. B. Bender, New Jersey Agricultural College. (discussion)
Under what conditions and to what extent can grass silage profitably replace hay or corn silage in the rations of dairy cows? F. B. Morrison, Cornell University. (discussion)
Dairy farming without corn. H. A. Herman, University of Missouri. (discussion)
1:30–3:30 P.M. Curricula Symposium—Auditorium, Fleming Museum.
3:30–5:00 P.M. General Business Session—Auditorium, Fleming Museum.

PRODUCTION SECTION—DIVISION A

Tuesday, June 24

W. E. PETERSEN, *Chairman*

1:30–3:30 P.M. Room 27, Williams Science Hall

Milk Secretion

P1—The hormonal preparation of rats for lactation. R. P. Reece, New Jersey Agricultural Experiment Station. 497.*

P2—The effect of thyroprive goat's milk on experimental hyperthyroidism. J. W. Hibbs, T. S. Sutton and W. E. Krauss, Ohio Agricultural Experiment Station. 498.

P3—The effect of thyroxine on the lactogenic hormone in the urine of dairy goats. Victor Hurst, Joseph Meites and C. W. Turner, Missouri Agricultural Experiment Station. 499.

P4—The effect of diethystilbestrol on milk secretion. Arless Spielman, L. M. Ludwick and W. E. Petersen, University of Minnesota. 499.

P5—Anatomy and physiology of the teat sphincter. Dwight Espe and C. Y. Cannon, Iowa State College. 500.

P6—A comparison of the utilization of β-hydroxybutyric acid, glucose and oxygen by the mammary gland of the normal and ketosis cow. J. C. Shaw, University of Connecticut. 500.

P7—The effect of glucose feeding upon the concentration of acetone bodies in blood and urine and upon the milk and milk fat produced in the normal bovine. C. B. Knodt, University of Connecticut. 501.

P8—The effect of ketosis and glucose therapy in ketosis upon milk fat synthesis. J. C. Shaw, University of Connecticut. 502.

P9—A study of normal variations of acetone bodies in the blood and urine of dairy cattle. C. B. Knodt, University of Connecticut. 502.

3:30–4:30 P.M. Section Business—Room 27, Williams Science Hall

Wednesday, June 25

1:30–3:30 P.M. Room 27, Williams Science Hall

Milk Secretion and Reproduction

P10—Glucose therapy in ketosis in cattle. J. C. Shaw and Ross C. Powell, Jr. University of Connecticut. 503.

P11—Progress report on the relation of the ration to the composition of milk. E. B. Powell, Ralston Purina Company. 504.

P12—The influence of frequency of milking on milk production. L. M. Ludwick, Arless Spielman and W. E. Petersen, University of Minnesota. 505.

* Numbers at the end of the title refers to the page number on which the abstract appears.

P13—The chlorine tolerance of certain mastitis bacteria. R. K. Waugh, P. R. Elliker, J. H. Hilton and J. F. Bullard, Purdue Agricultural Experiment Station. 506.

P14—The influence of oat juice extract upon the age of sexual maturity in rats. E. T. Gomez, A. M. Hartman and L. P. Dryden, Bureau of Dairy Industry. 507.

P15—The effect of a high and low protein ration on the gonadotropic content of male rat pituitaries. E. G. Weatherby and R. P. Reece, New Jersey Agricultural Experiment Station. 508.

P16—The evaluation of fertility in dairy bull semen. H. A. Herman and Eric Swanson, University of Missouri. 508.

P17—The effect of exercise on the amount and quality of a dairy bull's semen. O. L. Lepard, C. Edmund Shuart and Arden Foster, New Jersey Agricultural Experiment Station. 509.

P18—Some factors influencing the reproductive efficiency of Louisiana herds. D. M. Seath and C. H. Staples, Louisiana State University. 510.

3:30–4:30 P.M. Section Business—Room 27, Williams Science Hall

PRODUCTION SECTION—DIVISION B

Tuesday, June 24

H. A. HERMAN, *Chairman*

1:30–3:30 P.M. Room 11, Williams Science Hall

Herd Management and Feeding

P19—Progress report on a roughage program in herd management. C. B. Bender, New Jersey Agricultural Experiment Station. 510.

P20—Approved Ayrshire sire program. C. T. Conklin, Ayrshire Breeders' Association. 511.

P21—Some chemical determinations useful in silage studies. A. E. Perkins, Ohio Agricultural Experiment Station. 512.

P22—Corn meal as a grass silage preservative. G. Bohstedt, W. H. Peterson and G. P. Bahler, University of Wisconsin. 513.

P23—Trench silos for preserving cereals treated with molasses or phosphoric acid. H. A. Herman, A. C. Ragsdale and Warren Heathman, University of Missouri. 514.

P24—Calculating pasture yields with dairy heifers as experimental animals. H. B. Morrison and Fordyce Ely, University of Kentucky. 515.

P25—A study of the relationship of fat content in the dairy grain ration to milk and butterfat production. C. F. Monroe and W. E. Krauss, Ohio Agricultural Experiment Station. 516.

P26—The influence of sustained high fat intake upon milk fat production. N. N. Allen and J. B. Fitch, University of Minnesota. 516.

P27—The relation of mineral intake and sunshine to the vitamin D deficiency of mature dairy cattle. G. C. Wallis, South Dakota Agricultural Experiment Station. 517.

3:30–4:30 P.M. Section Business with Division A—Room 27 Williams Science Hall.

Wednesday, June 25

1:30–3:30 P.M. Room 11, Williams Science Hall

Vitamins and Minerals

P28—Observations on the quantitative requirement of mature dairy cattle for vitamin D. G. C. Wallis, South Dakota Agricultural Experiment Station. 518.

P29—Relation of skeletal reserves of calcium and phosphorus laid down during growth to persistence of milk production of dairy cows. L. S. Palmer and T. W. Gullickson, University of Minnesota. 519.

P30—The effect of feeding chloretone (trichlorobutyl alcohol) on the blood plasma ascorbic acid of dairy cattle. A. L. Bortree, E. C. Scheidenhelm and C. F. Huffman, Michigan State College. 520.

P31—Some observations on the carotene content of the blood plasma of dairy cows. Harold Goss and S. W. Mead, University of California. 521.

P32—Vitamin A levels in the blood plasma of dairy cattle on winter rations and the influence of vitamin A supplementation on certain constituents of the blood. Paul H. Phillips, P. D. Boyer, H. A. Lardy and N. S. Lundquist, University of Wisconsin. 522.

P33—The blood plasma vitamin A content of the newborn calf and its relation to certain calfhood diseases. Paul H. Phillips, N. S. Lundquist and Paul Boyer, University of Wisconsin. 522.

P34—The carotene (provitamin A) requirements of dairy cattle for lactation. A. H. Kuhlman and W. D. Gallup, Oklahoma A. and M. College. 522.

P35—Further studies of the effects of vitamin A deficiency on reproduction. S. L. Hansard and T. S. Sutton, Ohio State University and Agricultural Experiment Station. 523.

P36—Some ocular changes and deficiency manifestations in mature cows fed a ration deficient in vitamin A. L. A. Moore, Michigan State College. 524.

3:30–4:30 P.M. Section Business with Division A—Room 27, Williams Science Hall.

MANUFACTURING SECTION

Monday, June 23

2:00–4:00 P.M. Dairy Laboratory, Morrill Hall

Judging of Dairy Products

Tuesday, June 24

E. S. GUTHRIE, *Chairman*

1:30–3:30 P.M. Auditorium, Fleming Museum

Symposium—Properties and Utilization of Cream

Industrial problems. J. L. Hileman, Dairymen's League Co-operative Association, Inc.

Production of cream on farms and in plants. C. H. Parsons, Swift and Company.

Flavor. G. Malcolm Trout, Michigan State College.

Viscosity. Paul F. Sharp, Cornell University.

Whipping. H. H. Sommer, University of Wisconsin.

Freezing and storage. F. M. Scales, Sheffield Farms Company.

Reconstitution and utilization. R. Whitaker, Sealtest, Inc.

Churning. Emerson W. Bird, Iowa State College.

3:30–4:30 P.M. Section Business. Auditorium, Fleming Museum.

Wednesday, June 25

9:00–11:00 A.M. See Divisions A and B.

Wednesday, June 25

H. F. JUDKINS, *Chairman*

1:30–3:30 P.M. Auditorium, Fleming Muesum

Symposium—Milk Pasteurization

Engineering principles. G. W. Putnam, Creamery Package Mfg. Co.
Loomis Burrell, Cherry-Burrell Corporation.

Time-temperature inter-relationships in milk pasteurization. A. C. Dahlberg, New York (Geneva) Agricultural Experiment Station.

High-temperature pasteurization. G. C. Supplee, Borden Biological and Chemical Research Laboratories.

Control of thermoduric organisms. A. C. Fay, H. P. Hood & Sons.

Equipment sanitation from the health official's viewpoint. W. D. Tiedeman, New York State Department of Health.

The Public health aspect of quality control. Sol Pincus, New York City Department of Health.

The industrial aspect of quality control. M. E. Parker, Beatrice Creamery Company.

3:30–4:30 P.M. Section Business. Auditorium, Fleming Museum.

Thursday, June 26

9:00–11:00 A.M. See Division A and B.

1:30– 3:30 P.M. Curricula Symposium. Auditorium, Fleming Museum.

3:30– 5:00 P.M. General Business Session. Auditorium, Fleming Museum.

MANUFACTURING SECTION—DIVISION A

Wednesday, June 25

C. D. DAHLE, *Chairman*

9:00–11:00 A.M. Room 27, Williams Science Hall

Bacteriology

M1—The role of acid cleaning agents in dairy detergency. Milton E. Parker and G. W. Shadwick, Jr., Beatrice Creamery Company. 525.*

M2—The value of acidifying milk and cream cans from the standpoint of the effect upon quality. Alvin Rippen and L. H. Burgwald, Ohio State University. 525.

M3—The bacteriological spoilage of milk held near the freezing point. J. M. Sherman, G. M. Cameron and J. C. White, Cornell University. 526.

M4—Thermoduric bacteria in milk. III. The effect of changing agar and temperature of incubation for plate counts on the problem of thermoduric bacteria in milk. J. L. Hileman, Clarence Moss and Betty Stead, Dairymen's League Cooperative Association. 527.

M5—Effect of growth of *Pseudomonas putrefaciens* on aroma compounds in butter. P. R. Elliker and B. E. Horrall, Purdue University. 528.

M6—The effect of *Streptococcus agalactiae* upon the standard plate count of milk. Max E. Morgan and E. O. Anderson, University of Connecticut. 528.

M7—The lethal effectiveness of ultra-violet rays applied to milk. G. C. Supplee, G. E. Flanigan and O. G. Jensen, Borden Biological & Chemical Research Laboratories. 529.

M8—Bacteriological problems in short-time, high-temperature pasteurization. Harold Wainess, York Ice Machinery Corp. 530.

Thursday, June 26

9:00–11:00 A.M. Room 27, Williams Science Hall

Dairy Chemistry

M9—The foaming of milk and certain milk products in relation to their surface-active constituents. M. S. El-Rafey and G. A. Richardson, University of California. 530.

M10—Factors affecting the gas content of milk. C. I. Noll and G. C. Supplee, Borden Biological & Chemical Research Laboratories. 531.

M11—Factors influencing the response of cream to a rebodying process. F. M. Skelton and H. H. Sommer, University of Wisconsin. 532.

* Numbers following the titles refer to the page number on which the abstract appears.

M12—An improved micro-Kjeldahl apparatus and procedure for the analysis of milk. M. C. Rhees, T. R. Freeman and Chas. N. Shepardson, A. & M. College of Texas. 533.

M13—A progress report on the utilization of apple products, especially apple syrups and juices, in producing soft-curd milk. C. C. Flora and C. W. Holdaway, Virginia Agricultural Experiment Station. 534.

M14—The determination of citric acid in milk by the pentabromo-acetone method. E. F. Deysher and George E. Holm, Bureau of Dairy Industry. 534.

M15—The effect of flash forewarming upon the heat stability of evaporated milk. B. H. Webb and R. W. Bell, Bureau of Dairy Industry. 535.

11:00–12:00 A.M. Section Business. Room 27, Williams Science Hall.

MANUFACTURING SECTION—DIVISION B

Wednesday, June 25

L. H. BURGWALD, *Chairman*

9:00–11:00 A.M. Room 11, Williams Science Hall

Ice Cream and Milk

M16—The influence of homogenizing pressures on the "dryness" of ice cream when drawn from the freezer. J. H. Erb and John Whitworth, Ohio State University. 535.

M17—Monoglyceride-gelatin as an ice cream stabilizer. P. S. Lucas, Michigan State College. 536.

M18—A method for the preparation of acid casein for use in ice cream. L. P. Teichert, T. R. Freeman, W. S. Arbuckle and Chas. N. Shepardson, A. & M. College of Texas. 537.

M19—The temperature method for control of whipping in ice cream. Alan Leighton, Bureau of Dairy Industry. 538.

M20—Motion pictures as a medium for the study of ice cream. W. H. E. Reid, C. W. Decker, L. E. Smith, K. R. Minert, W. S. Arbuckle, and Joe Edmondson, Missouri Agricultural Experiment Station. 538.

M21—Homogenization index as calculated from measurements of fat globule size. A. W. Farrall, C. C. Walts and R. L. Hanson, Creamery Package Manufacturing Company. 539.

M22—The effects of the direct addition of carotene and mixed tocopherols on the development of oxidized flavor in milk. Edwin B. Williams and L. H. Burgwald, Ohio State University. 539.

M23—The influence of treated fibre milk containers on the incidence of copper-induced and sunshine oxidized flavors of milk. C. L. Roadhouse and J. L. Henderson, University of California. 540.

M24—An electric laboratory pasteurizer. H. B. Henderson, Thos. B. Harrison, C. E. Wylie, and H. A. Arnold, University of Tennessee. 541.

M25—Observations regarding the occurrence of oxidized flavor in milk from individual cows. H. B. Henderson, W. W. Overcast, and C. E. Wylie, University of Tennessee. 541.

M26—A small electric holder type pasteurizer. C. W. England, Arthur P. Wiedemer, and George J. Burkhardt, Maryland Agricultural Experiment Station. 542.

Thursday, June 26

9:00–11:00 A.M. Room 11, Williams Science Hall

Cheese and Butter

M27—Some factors influencing the quality of cream cheese. B. M. Zakariasen and W. B. Combs, University of Minnesota. 543.

M28—A short method of making a soft cheese similar to cream cheese. E. L. Reichart and L. K. Crowe, University of Nebraska. 544.

M29—A survey of commercial cottage cheese. Milton J. Foter, E. O. Anderson and L. R. Dowd, University of Connecticut. 544.

M30—The relationship of acidity to the quality of American Cheddar cheese. H. L. Wilson, S. A. Hall, and H. R. Lochry, Bureau of Dairy Industry. 545.

M31—Keeping quality of butter stored at low temperature for six years. B. J. Scheib, E. S. Guthrie, and C. N. Stark, Cornell University. 545.

M32—Mold mycelia in cream. E. R. Garrison and J. H. Gholson, Missouri Agricultural Experiment Station. 546.

M33—The effect of udder infection and late lactation on the methylene blue-borax test for mold mycelia in cream. E. R. Garrison and J. H. Gholson, Missouri Agricultural Experiment Station. 547.

M34—The effect of various factors on mold mycelia in cream and butter. W. H. E. Reid, Joe Edmondson, and W. S. Arbuckle, Missouri Agricultural Experiment Station. 548.

1:30–3:30 P.M. Auditorium, Fleming Museum

H. B. ELLENBERGER, *Chairman*

Symposium-Curricula

ABSTRACTS OF PAPERS

EXTENSION SECTION

E1. Supervisory Standards for State Men in Charge of D.H.I.A. Work.

R. G. Connelly and R. W. Dickson, Virginia Polytechnic Institute.

Dairy herd improvement association records are used in compiling proved-sire records which are accepted and used widely as a basis for dairy cattle improvement; therefore, it is important that minimum standards of supervision be established to insure the accuracy and reliability of all dairy herd improvement association records regardless of the association or state in which they are obtained.

Minimum standards of tester training and the supervision he receives to insure accurate and reliable records may be listed as follows:

A. Qualification of Tester.
   1. Farm experience, preferably dairy farm experience.
   2. Training.
      a. High School graduate with Vocational Agriculture training.
      b. Satisfactorily completed D.H.I.A. tester training short course of not less than four weeks, preferably six weeks. Short course to be conducted by State Agricultural College.
      c. Licensed by State to conduct Babcock test.

B. Supervision of Tester.
   1. Field Supervision.
      a. Coach each new tester in the testing and record work of at least two herds.
      b. Inspection of testing equipment annually, for completeness and working condition.
      c. Report by tester to county agent monthly and present association monthly summary report.
      d. Visit tester at least twice a year to observe his work. The county agent or extension dairyman may make visits.
      e. Hold semi-annual conferences with at least twenty per cent of association membership to check quality of service rendered by tester.
      f. Examine at least four record books selected at random from each association to see that records are complete in data recorded and calculations accurate.
   2. Conferences.
      a. Annual, preferably semi-annual, regional conferences held with testers by extension dairymen where testing problems

and methods are discussed to acquaint testers with current information on up-to-date testing work.

b. Individual semi-annual conferences with testers by extension dairyman to discuss problems of D.H.I.A. work and to correct inefficiencies of the tester.

C. Office Records.

1. Testers to submit monthly barn sheets to state office. Barn sheets to be used as a check on the monthly work of the tester and as a permanent file.
2. State office to disperse ear tags to testers and to keep permanent record of B.D.I. 717 and B.D.I. 718 reports.
3. State office to prepare annual statistical summaries for annual meeting of each organized association.

E4. Survey of Modified Testing. Summary of Report for the Testing Committee. E. H. Loveland, University of Vermont.

Reports were received from 28 states relative to modifications in method of conducting dairy test record work with farmers. Seven states report "owner-sampler" plan where samples of milk taken by the owner are tested cooperatively, either through a regular D.H.I. association or through an organization set up for that purpose. Four report favorably and three report unfavorably on this plan. Five states report bi-monthly testing as a modified form of regular D.H.I. work. Three report favorably, one unfavorably, and the other undecided. Seven states report no modifications, with the remainder minor modifications.

In Vermont, the bi-monthly system of testing has been in successful operation for over a year with seven associations sponsored by creamery organizations. On January 1, 1941, these associations had 301 herds with 6289 cows on test. Up to January 1, 1941, six associations had completed their first year of testing with an average production of 227 lbs. fat per cow against a state D.H.I.A. average of 291 lbs. for the monthly associations. These bi-monthly associations are apparently reaching many average dairymen who never had, and probably never would pay the price for membership in a regular monthly association. One association has finished its second year with 70 per cent of the herds testing for two years showing improved production and efficiency, indicating that the bi-monthly form of testing was successful in herd improvement. A normal percentage of herds is continuing into the second and third year of testing.

A comparison of creamery deliveries with bi-monthly estimates shows the herd totals to be as accurate as those found in monthly associations. There is a marked tendency among the more interested members to shift to a monthly form of testing as soon as such service is available. Bi-monthly testing is not generally considered as satisfactory as monthly testing. The

bi-monthly association is recognized for publicity and records are accepted on the same basis as those of a monthly association. Because of greater length of time between visits, the bi-monthly association requires greater skill on the part of the tester to make adjustments in the records and to help the farmer in herd improvement.

E5. Method of Reporting Kinds and Quality of Feed in Dairy Herd Improvement Association Work. A. J. CRAMER, University of Wisconsin.

Feeding records are only as valuable as they are complete. Herd owners should cooperate with the fieldman and see that he weighs the feed at night as accurately and completely as possible for each cow. If the hay, silage, and grain are not weighed on each month's visit by the fieldman, the herd owner will not receive full value for the money he has spent in Association membership dues or fees.

Cows should be fed according to their individual production, to obtain the greatest returns for the feed consumed. The ultimate purpose of keeping complete feeding records is to enable the dairyman to improve his herd production through practicing intelligent and efficient feeding methods. On many farms, the feed cost of a cow represents about half of the total cost of keeping her. That's why its so important to obtain as nearly accurate feed weights as possible. The feed weights one day each month serve as a basis for charging the feed costs for the entire month.

Recommended practices for fieldmen are: *First*, the ration being fed should be recorded on the back inside cover of the member's herd record book. *Second*, the prices paid for purchased feeds, and the values of home-grown feeds are to be recorded in the back of the book. *Third*, the complete record of all feeds fed should be listed on the monthly herd summary page in the herd book. *Fourth*, the total pounds of hay, silage, and grain, and the per cent of protein is to be listed for each individual cow. *Fifth*, a barn-feeding chart called a feeder's guide is posted over the feed box listing the cows, the amount of butterfat each cow produced that month, and the recommended amount of grain each cow might receive each feeding according to her production. The results of feeding according to production in one herd showed a gain of 40 pounds daily in milk, or $18.00 higher returns over feed cost for that month.

At the close of the year, the fieldman will have the feed totals for each cow and the totals of all feeds on the entire herd. These feed weights are helpful in determining the amount of feed needed for the herd the next year.

The difference in quality of roughage and grain is reflected in the price. We aim to use uniform prices within a county for similar quality of feeds, using the price of home-grown feed at what it is worth on the farm. The purchase price is used on all feeds.

The time of purchase, the quantity, and the quality of feeds used are price determining factors.

If comparisons are made as to the production efficiency of herds, uniform prices for butterfat as well as for similar quality of feeds fed should be used.

The weak spot in our records is the lack of feed information gathered by the fieldman. It is important that fieldmen use care and exact methods in weighing all roughage and grain every month; reporting kinds, amounts, and quality of feed used in Dairy Herd Improvement Association work. Such information is valuable in building toward more efficient production records.

E6. New D. H. I. A. Conversion Factors—By Breeds. J. F. KENDRICK, Bureau of Dairy Industry.

For some time it has been generally recognized that the age-conversion factors used in compiling dairy herd-improvement association proved-sire data for all breeds are not entirely satisfactory for converting production records of individual breeds of cows to a mature-equivalent basis.

Heretofore sufficient data were not available to justify a study of the relationship between age and production by breeds. Through the operation of the Nation-wide dairy herd-improvement association proved-sire program, however, the States have reported 305-day lactation records for permanent recording and data have accumulated in sufficient volume so that a study could be made and reliable age-conversion factors for each breed could be developed.

Such a study was made of the records of approximately 17,000 Ayrshire, 8,000 Brown Swiss, 64,000 Guernsey, 63,000 Holstein, and 60,000 Jersey cows. In one part of the study a straight tabulation of 305-day lactation records for cows of each breed for different ages was compiled. That is, the records of all cows 2 years of age were added and averaged, the records of all cows 3 years of age were added and averaged, and so on for the various ages. In another part of the study only the records of cows with two or more consecutive lactation records were used in an effort to determine the degree of slope of the production trend line from year to year and thereby tend to reduce the influence of culling.

New age-conversion factors, based on the results of this study, by breeds, are recommended for adoption by the American Dairy Science Association for use in dairy herd-improvement association proved-sire work.

E7. Uniform Annual Reports for Artificial Breeding Associations, Including Standardized Methods of Calculating Conception Rates. RALPH A. CORBETT, University of Maine.

With more than twenty states having one or more Artificial Breeding Associations there is need for a uniform method of reporting activities and

progress of these associations on a state and national basis. This would assist those people now engaged in the successful operations of these associations to profit by the methods and results of all other associations.

There is need within every association for certain standard forms. These include: (1) Daily Bull Semen Report, (2) Breeding Receipt, (3) Farmers Cow Breeding Record, (4) Individual Cow Case Card (or equivalent), (5) Daily Bull Report of Conception Efficiency, (6) Yearly Annual Report, and (7) Simple but Complete Financial Report Forms.

At present there is a wide variation in the methods used in calculating conception rates which may influence decidedly the final success of the associations. These methods should be standardized within the state and nation, so that everyone will be measuring results comparable to all other results. For example: In associations where three services per cow are allowed, results may be calculated on two services as practically every man who has paid for three services will call for them. In many cases it may be difficult to determine what happens with the cow after three services—if conception is figured on three or more services. Where pregnancy examinations are not being carried out, if a cow does not show signs of oestrum for six weeks following breeding she may be considered in calf, although a small per cent will prove to be open.

Uniform Annual Reports would be especially helpful. They might include:

1. Number members enrolled.
2. Number members having cows inseminated during year.
3. Number different cows inseminated.
4. Number of total inseminations.
5. Number cows pregnant. Number failing to conceive.
6. Breeding ratio.
7. Number cows becoming pregnant on one, two, and three services.
8. Names and number of each bull used with the breeding record of each bull.

E8. Roughage Investigations by the Bureau of Dairy Industry. T. E. WOODWARD AND J. R. DAWSON, Bureau of Dairy Industry.

This is a review of the work done by the Bureau of Dairy Industry at Stations located in a number of states, together with a discussion of the practical implications of the work.

A total of 134 year records on roughage alone has been obtained. There is a considerable number of other records made by supplementing the roughage with moderate amounts of grain. The production that can be expected when different methods of feeding are practiced is discussed, together with the conditions under which grain supplements will pay.

Some 150 to 175 lots of experimental silage, mostly with the hay crops,

have been made in the last few years, and these have been fed for considerable periods in a number of cases. The place of grass and legume silage in dairy farming is discussed.

The yield of different crops for pasture has been determined and methods of pasture management have been studied. The conditions under which rotation grazing and the use of annual and supplementary pastures are desirable are discussed.

The utilization of crops in the form of pasturage, hay or silage has been studied with reference to yields, feeding value, and loss of nutrients. This work is discussed with reference to its practical aspects.

E11. A Study of the Growth of 4-H Dairy Heifers and the Reliability of Heart Girth Measurements as a Means of Estimating Liveweight. H. A. WILLMAN AND G. W. SALISBURY, Cornell University.

Few farms are equipped with scales suitable for weighing dairy cattle. Some dairymen have not realized how small their cattle appeared to others until they have lost a sale. In some sections of New York State where breeders depend to some extent on the income from the sale of surplus replacement cattle, buyers frequently offer the criticsm that the cows and young stock are too small.

It is apparent also that some 4–H members are not growing their yearling cattle too well. They have not been checking the growth or size of their cattle because scales are not available. Because of this, an accurate or at least some practical means of estimating weights and determining gains would be useful. Likewise, the regular and frequent use of the tape should help in stimulating and maintaining the interest of the 4–H member in the proper development of his cattle.

Several investigators already have demonstrated that a relationship exists between heart girth measurements and liveweight. Kendrick and Parker[1] of the Bureau of Dairy Industry, United States Department of Agriculture and Ragsdale[2] of the Missouri Station have published tables for estimating the live weights of cattle from heart girth measurements.

From these data tape measures have been developed, on one side of which there appears the measurements in inches and on the other side the estimated weights.

Because of the ease with which the heart girth measurement can be taken, it seemed desirable to study not only the relative growth or size of 4–H heifers but to determine how accurate an estimate of body weight could be obtained on a group of 4–H calves and heifers by means of the tape in common use. Apparently no one else has reported on a study of this sort,

[1] Bureau of Dairy Industry, Bull. 695, 1936.

[2] Missouri Bull. 354.

especially on heifers of widely different breeding which had been raised on many different farms and fed by different feeders under varying conditions.

The objects of study were:

1. To determine whether 4–H club boys and girls are growing their young stock satisfactorily.
2. To determine the reliability of heart girth measurement[1] weight estimates as compared with actual scale weights for each breed.
3. To determine the direction of error in estimating weights by the tape[1] if differences occur.

A study of data on 126 head of unselected 4–H cattle ranging in age from 5 to 35 months which were exhibited at the 1940 New York State Fair indicated that:

1. Most of the 4–H heifers of the younger ages were heavier than the suggested standard weights[2] while the older heifers often weighed less than the standard.
2. The weight tape[1] in common use in the state is more accurate in estimating the weights of Holstein heifers than in estimating the weights of Ayrshires, Guernseys, and Jerseys.
3. The tape weight estimates on calves of the smaller breeds were significantly higher than the actual weights when studied statistically.
4. No evidence was obtained to indicate that the small variation in the condition of the heifers influenced the estimate of liveweight.

E12. A Junior Program Designed to Supplement the General Adult Dairy Quality Improvement Program. EVERT WALLENFELDT, University of Wisconsin.

Junior groups who have acquired "dairy sanitation consciousness" have often remedied faulty practices which milk inspectors and dairy fieldmen have sometimes failed to accomplish by working with adults alone. In order to take advantage of this factor to the greatest extent feasible, the Wisconsin dairy industry extension service has carried on a broad junior extension program for dairy quality improvement. The aim has been to supplement and not to replace in any way the general adult dairy quality improvement program which has been carried on for many years.

The success of such a program depends on the development of dairy sanitation consciousness and practical applications on the part of local agricultural and home economics leaders as well as on the part of the boys and girls participating.

Some of the tools used extensively are: (1) dairy products judging contests, (2) dairy demonstration contests, (3) dairy exhibit contests and (4) special project activities such as construction of cooling tanks and milk

[2] Morrison, F. B., Feeds and Feeding, 20th ed., p. 615.

houses, cow clipping rings and methylene blue and sediment testing, etc. A large number of voluntary local leaders have been enlisted to help with this work.

The junior dairy products judging work consists of several separate phases. (1) 4–H Club dairy products judging schools and contests, (2) F.F.A. and F.H.A. dairy products judging schools for teachers and contests for members, (3) rural school teachers judging schools and contests for rural school pupils in upper grades.

The 4–H Club phase includes: (1) a number of district dairy products judging training meetings (12 during 1941) for both 4–H leaders and members, (2) the conducting of county contests, (3) assisting county agents in the procuring and scoring of samples for local contests, and (4) a state 4–H Club dairy products judging contest at the Junior State Fair. Dairy products are now also included in the Junior Fair foods judging contests which involves the foods and nutrition project members from practically all counties in the state.

The F.F.A. dairy products judging work done by the extension specialists is covered largely by the following: (1) district dairy products judging schools for agricultural teachers (five were held during 1941), (2) assistance with subject matter material and the scoring of products for local judging contests where feasible. The F.F.A. dairy products judging is climaxed by a statewide F.F.A. dairy products judging contest which is conducted by the resident staff of the department of dairy industry and the specialists.

The F.H.A. dairy products judging was started by a dairy products judging meeting for all the high school rural home-making instructors at their state conference. This was followed with district dairy products judging training schools for all of these home economics teachers (five during 1941).

Dairy products judging training meetings for rural district school teachers have been conducted by the specialists. Contests for rural school contestants have also been held but it is expected that the county agents and high school teachers will handle these themselves in the future.

The dairy demonstration program consists of (1) county and district demonstration training meetings for 4–H leaders and members, (2) district demonstration training meetings, (3) six district dairy demonstration contests and a final state contest at the Junior State Fair for the district winners in each of the two divisions, dairy production and dairy foods.

The demonstration phase of the junior program reached the greatest number of people in that the 650 demonstrators participating gave their demonstrations before audiences totaling about 84,500 people in over one-half of the counties, but the dairy products judging program has been carried into every county of the state.

E13. Milk and Cream Loss Prevention for 4-H Club Members. M. L. FLACK, University of Nebraska.

During the spring of 1940 the State Quality Committee and butter manufacturers working with the extension service of the Agricultural College put into operation a "Milk and Cream Loss Prevention" project. This project became a part of the state 4-H Club program where all 4-H Club members regardless of the type of work carried could compete.

In the past, considerable work has been done in Nebraska on quality improvement of dairy products; but none of them seemed to attract as much attention or receive as much favorable comment as the "Milk and Cream Loss Prevention" did the past year.

It was the intention of the State Committee on quality as well as dairy manufacturers to center attention on the improvement needed on the farm around the dairy farm buildings with special emphasis on the importance of destroying weeds that cause off-flavors in milk and cream.

In the middle west weeds have become a terrible menance to the dairy industry. This is especially true where pastures have been killed out by the long continued drouth. It has been estimated by the dairy industry that the farmers of the middle west have lost annually thousands of dollars from poor or low quality cream caused by weeds in the pastures, the worst offender being pennycress, or stink weed.

The Quality Committee and butter manufacturers working through the 4-H Club department made available rather liberal awards for five different kinds of competition in this "Milk and Cream Loss Prevention" work. Around 23,000 Club members learned about this work and awards offered through their County Agriculture Agent and 4-H Club leaders.

Money awards were offered for the following competition:

1. Awards for 4-H Club team demonstrations portraying new and better methods of handling milk and cream for its improvement. These teams in order to qualify for the award had to put on their demonstration at least three times in their home community and at County and State Fairs.
2. Awards for Posters dealing with the elimination of milk and cream losses. These posters to be displayed at County and State Fairs.
3. Awards for news articles written for local and state press on "How to Eliminate Losses on Milk and Cream" caused by contamination with weeds and other foreign material.
4. Awards for booths at County and State Fairs setting out approved methods of pasture management and other measures for improving milk and cream on the farm.
5. Awards for the Clubs as groups where they cooperated in destroying weeds in their community as well as cleaning barn yard. This to be done by mowing and burning the weeds wherever found.

The State Quality Committee as well as the 4-H Club and Extension Departments were well satisfied with the results received this past year. A number of very effective demonstrations were put on in communities and at the State Fair. One demonstration team demonstrated before more than 3,000 people in different communities. One 4-H Dairy Club in the state was responsible for the destruction of 700 acres of weeds in their community. A number of good news articles were prepared and published in various newspapers and farm papers in the state. Several very effective booths were exhibited during the State Fair, and at many County Fairs. One leader made the remark that his club through these contests had made their whole community weed conscious and that many of the farmers were taking steps to rid their farms of this pest.

E14. The Dairy Quality Improvement Program in Wisconsin. DAVE NUSBAUM, University of Wisconsin.

The Department of Agriculture and the College of Agriculture in Wisconsin have jointly adopted a quality milk program which is put on in the state on a county by county basis and now covers nearly half of the state.

The program consists largely of the education and development of quality consciousness on the part of both milk producers and plant operators.

County Agricultural Agents are key men in the program. Meetings which are conducted by farmers are held in every schoolhouse in a county at the beginning of the program. All dairy plants in the county grade milk by the methylene blue test and the sediment test and cream by taste and smell. The results of these tests are sent to the farmers by the plant. The college specialists and the county agent are largely responsible for the educational phases of the program—the Department of Agriculture handles the regulatory end of the program.

As a result of this work, many plants in the state are adopting systems of paying for milk and cream by grade.

The standards which are used in the program would be applicable to other sections of the country.

Manufacturing records of many plants in the state indicate a definite improvement in the quality of manufactured products. This frequently has resulted in an increase in price received or in the establishment of a better market.

This program is set up primarily for cheese, butter, and evaporated milk sections in the state.

PRODUCTION SECTION

P1. The Hormonal Preparation of Rats for Lactation.* R. P. REECE, New Jersey Agricultural Experiment Station.

A study was made of the possibilities of preparing rats for lactation by hormonal administration. Forty-two experimental rats were used in this work.

When a normal rat mated, another sexually mature rat was started on hormonal treatment. In the majority of experimental rats injections were initiated when they were in estrus. Vaginal smears were made daily to determine if a prolonged luteal phase ensued. Two to three days following parturition in a normal rat the pups were transferred to an experimental rat. Litters were standardized at 6 and they were frequently observed in order to determine if they had nursed. Litter body weights were recorded daily. Some of the rats which did not raise their litters, were sacrificed and their mammary glands observed macroscopically to ascertain the degree of mammary development.

The results are summarized under the headings of hormonal treatment which the experimental rats received.

No treatment.—Four multiparous rats nursed but did not raise their litters.

Gonadotropic principle of pregnancy urine (*Follutein*).—Four multiparous rats failed to raise litters placed with them. The mammary glands of one rat were not well developed while the glands of the remaining 3 rats were well developed.

Follutein plus an estrogen (*Progynon–B*).—Six rats, 2 virginal and 4 multiparous, failed to raise the litters placed with them. There was no evidence of nursing in 5 of the 6 litters. The glands of 3 rats were not extensively developed.

Gonadotropic principle of pregnant mare serum (*Gonadin*).—Seven rats received Gonadin injections, but, litters were available for only 6 of the rats. One of the 6 rats raised 2 successive litters, the first litter averaged 52 grams at 21 days and the second litter averaged 34 grams at a similar age. Of the remaining 5 rats for which litters were available 2 did not show signs of maternal instinct. Although a litter was not available for the seventh rat milk could be expressed from the teats.

Gonadin plus Progynon–B.—Of 9 rats, 2 virginal and 7 multiparous, 7 failed to raise their litters. The average body weight at 21 days in one litter was 45 grams while in the second litter it was 40 grams. Maternal instinct was lacking in 6 of the 9 rats. The glands of one rat were extensively developed and filled with milk.

* Journal Series Paper of the New Jersey Agricultural Experiment Station, Rutgers University, Department of Dairy Husbandry.

Progynon–B.—Of 12 rats injected with Progynon–B, 5 raised their litters and one raised 4 of 6 pups. The average body weights in grams of the pups at 21 days were: 37; 34; 32; 33; 51; and 36. One of the 12 rats failed to nurse her liter. The glands of 3 rats were examined. The glands of one rat were well developed and contained some milk, the glands of the second rat consisted mainly of an extensive duct system and contained a small amount of milk, while the glands from the third animal showed complete development and it was possible to express milk from the teats.

P2. The Effect of Thyroprive Goat's Milk on Experimental Hyperthyroidism. J. W. Hibbs, T. S. Sutton, and W. E. Krauss, Ohio Agricultural Experiment Station.

Clinical reports of the effectiveness of thyroprive goat's milk in the alleviation of the symptoms of hyperthyroidism prompted the present study.

Preliminary work in which the effects of normal goat's milk on the basal metabolic rate of rats were compared with that of milk from a thyroidectomized goat,[1] produced slight although erratic and unreliable evidence that thyroprive goat's milk effected a lowering of metabolic rate.

Since the clinical reports of the efficacy of thyroprive goat's milk were obtained by feeding such milk to hyperthyroid patients, it was considered advisable to study the effects on hyperthyroidism experimentally produced in rats.

Three groups of littermate male rats were maintained on a milk ration for a period of two weeks. Eleven animals were used in each group. Post absorptive metabolic rates were determined on the first, eighth and fifteenth day. Beginning on the ninth day and continuing through the fourteenth day each rat was treated with thyroxin, administered by subcutaneous injection at the rate of 0.2 mg. per 100 gm. body weight.

During the first week in which the milk was fed but no thyroxin injected, there was no significant change in metabolic rate. Minor inconsistencies may be explained by our inability to get a true basal due to activity of the animal. Several runs usually must be made before the animal becomes accustomed to the apparatus.

Following thyroid treatment, metabolic rates rose sharply but not all to the same level. The B.M.R. of those receiving cow's milk increased an average of 82 per cent, those receiving normal goat's milk increased on the average of 85 per cent, while the average increase in B.M.R. of those receiving thyroprive goat's milk was 68 per cent. This difference of 14 per cent and 17 per cent between the metabolic rate of rats receiving thyroprive goat's milk and those receiving cow's or normal goat's milk, respectively, is

[1] We gratefully acknowledge the assistance by Dr. Harold Beeson who performed the thyroidectomy.

interpreted as significant evidence of the presence of an antithyroxin principle in thyroprive goat's milk.

P3. The Effect of Thyroxine on the Lactogenic Hormone in the Urine of Dairy Goats.* VICTOR HURST, JOSEPH MEITES, AND C. W. TURNER, Missouri Agricultural Experiment Station.

During the past few years numerous investigations have shown that the administration of thyroid tissue or thyroxine has stimulated increased milk secretion especially during the declining phase of lactation in dairy cattle and goats. A number of theories have been advanced to explain the mode of action of thyroxine in stimulating increased yield of milk. It is possible that its action is through increasing heart rate with an increased volume of blood flowing to the udder. There follows also an increased cellular activity as shown by the increased metabolic rate, thus the epithelial cells of the mammary gland might be stimulated to a more rapid rate of milk synthesis. Thyroxine might increase the availability of the precursors of milk in the blood resulting in a greater uptake by the udder. There is also the possibility that one or more pituitary hormones which influence lactation might be secreted in greater amount.

As a method for the extraction and assay of the lactogenic hormone in the urine has been developed in our laboratory, it seemed of interest to compare the concentration of lactogen before and after thyroxine administration to lactating goats. The urine used for extraction was collected for 2 days prior to and 5 to 6 days following injection during which time the maximum rise in milk yield occurs.

While the work is still in progress and there may be variations to report later, there is at present no indication of a significant increase in the amount of lactogenic hormone in the urine of goats following thyroxine injection even with a material increase in the level of milk production.

P4. Effect of Diethylstilbestrol on Milk Secretion.† ARLESS SPIELMAN, L. M. LUDWICK AND W. E. PETERSEN, University of Minnesota.

Discovery of the estrogenic activity of diethylstilbestrol by Dodds, Goldberg, Lawson and Robinson has greatly facilitated the study of estrogen function in milk secretion.

This preliminary report deals with the effects of artificial administration of diethylstilbestrol on milk secretion. At this writing four lactating cows have been under observation for thirty days. Various amounts of diethylstilbestrol in cottonseed oil ranging from 10 to 100 milligrams have been injected intramuscularly at irregular intervals.

* Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series No. 739.

† The diethylstilbestrol was furnished by Merck and Co.

Results to date have shown a marked increase in the butterfat and lactose percentage by 1 to 1.5 with no apparent effect on total milk production. Total protein and casein protein have not changed. A striking corollary is the marked rise of 100 or more mg. per cent in the level of blood fat and a significant increase in blood sugar. The increase in butterfat percentage began to decline about 48 hours after terminating the injections and returned to normal within five days. The increase in lactose secretion has persisted longer, as has the increase in blood fat and blood sugar.

The amount of diethylstilbestrol necessary to give the above results seems to be about 50 to 150 mg. for the cows used. The latent period has been about three days.

These results substantiate the report by Folley and Watson that diethylstilbestrol produced a prolonged increase in both the fat and lactose content of milk.

P5. Anatomy and Physiology of the Teat Sphincter. DWIGHT ESPE AND C. Y. CANNON, Iowa State College.

X-ray pictures give no indication that any vacuum develops at the end of the teat when the pressure exerted in milking is released. The length and tone of the teat sphincter may be of importance in preventing bacteria from entering the mammary gland.

P6. A Comparison of the Utilization of β-hydroxybutyric Acid, Glucose and Oxygen by the Lactating Mammary Gland of the Normal and Ketosis Cow. J. C. SHAW, University of Connecticut.

Blood samples for arteriovenous difference work were drawn simultaneously from the internal iliac artery and the subcutaneous abdominal mammary vein. The data to be presented include only those analyses made on bloods undergoing no blood concentration changes in the mammary gland. In fifteen experiments on normal cows there was a mean utilization of 1.83 ± (S.E.) 0.246 mg. per cent β-hydroxybutyric acid and 4.70 volumes per cent oxygen. In six arteriovenous differences in ketosis where the total blood acetone bodies exceeded 15 mg. per cent there was a mean utilization of 3.91 mg. per cent β-hydroxybutyric acid and 3.60 volumes per cent oxygen. The normal arteriovenous glucose difference for 40 cows was 9.3 mg. per cent. In 9 arteriovenous differences on ketosis cows with arterial blood sugar values below 35 mg. per cent there was a mean utilization of 9.5 mg. per cent. The failure of the gland to utilize more oxygen with the increase in the utilization of β-hydroxybutyric acid may be due to the use of this blood substance directly for synthesis. If, however, it is used by the gland for energy purposes the lack of an increase in oxygen utilization in ketosis appears to be best explained by a shift from a normal oxidation of other fat to an increased oxidation of β-hydroxybutyric acid. Due to the fact that most

tissues of the body apparently use β-hydroxybutyric acid for energy purposes, any hypothesis that this substance is used in actual synthesis must be accepted with reservation. It is difficult to explain, however, just why the gland should use only β-hydroxybutric acid for energy purposes since the other tissues apparently invariably use both β-hydroxybutyric acid and acetoacetic acid.

P7. The Effect of Glucose Feeding Upon the Concentration of Acetone Bodies in the Blood and Urine, and Upon the Milk and Milk Fat Produced in the Normal Bovine. C. B. KNODT, University of Connecticut.

The normal level of blood and urinary acetone bodies as well as the normal levels of milk and milk fat production were established prior to the glucose feeding period. The glucose was fed in the form of corn sugar three times per day in addition to the regular ration to the extent of six pounds per day for a ten day period to each of two cows; and six pounds per day for a period of twenty-five days to each of two other cows. Another cow was fed three pounds per day for a three day period, six pounds per day for the next three days, and this was increased to nine pounds per day for a period of four days. This cow received ten and one-half pounds per day for the next three days but on the evening of the third day she failed to consume all of the glucose fed but continued to consume six pounds per day for the next nine days.

After twenty-four hours of glucose feeding the concentration of blood and urinary acetone bodies had decreased 35.13 per cent and 23.46 per cent respectively. After three days of feeding, the concentration of blood and urinary acetone bodies had fallen 48.73 per cent and 54.08 per cent respectively. After ten days of continuous glucose feeding at a level of six pounds per day the concentration of blood and urinary acetone bodies was found to be 58.54 per cent and 52.62 per cent of the previously determined normal levels respectively. After twenty-five days of continuous glucose feeding at a level of six pounds per day the concentration of acetone bodies in the blood and urine was found to be 44.02 per cent and 60.00 per cent respectively of the established normals. Three days after the cessation of glucose feeding the levels were found to be 51.27 per cent and 45.92 per cent respectively in the blood and urine of the established normal concentrations. Six days after the cessation of feeding the blood and urinary acetone bodies were found to be 47.71 per cent and 56.55 per cent of the previously determined normal levels.

The average milk and milk fat production was 1.02 per cent and 10.37 per cent respectively below normal for the first ten days of feeding. The average milk and milk fat production for the twenty-five day feeding period was found to be 3.91 per cent and 10.05 per cent below normal respectively.

The milk and milk fat production for the six day period after the cessation of feeding was found to be 5.17 per cent and 3.50 per cent below normal respectively.

The saponification number, the Reichert-Meissl and Polenske values, and the iodine numbers were determined but no significant differences were found when the food intake was regulated so that the experimental animals did not refuse food. A fall in short chain fat acids was observed when large quantities of glucose were pumped into the rumen but is believed to be due to the refusal of food which followed.

P8. The Effect of Ketosis and Glucose Therapy in Ketosis upon Milk Fat Synthesis. J. C. SHAW, University of Connecticut.

In severe ketosis with the blood sugar and lactic acid low and acetone bodies high the short chain fatty acids of milk are quite low as shown by the various fat constants. In recovery in a four-week period with an increase in the blood sugar level from 20.9 mg. per cent to 44.9 mg. per cent the saponification number increased from 213.5 to 227.2, the Reichert-Meissl increased from 22.3 to 27.44 and the Polenske value increased from 1.49 to 2.90.

Pumping 6 pounds of glucose into the rumen of another cow by stomach tube resulted in 48 hours in an increase in glucose from 15.0 to 42.2 mg. per cent, the saponification number increased from 215.6 to 218.8, the Reichert-Meissl number increased from 25.4 to 28.9, the Polenske number increased slightly from 2.1 to 2,3. The iodine value showed a surprising increase from an already high value of 48.2 to 51.4. That the low blood glucose is not necessarily directly responsible for the abnormal fat constants is indicated by values obtained from the same cow three weeks later. At that time with a blood sugar value of 24.4 mg. per cent the saponification number was 228.0, the Reichert-Meissl number was 33.4, the Polenske number was 2.8 and the iodine number was 41.1. The cow was in much better condition clinically at that time and was eating fairly well although the blood acetone bodies were quite high. The milk fat constants for a number of ketosis cows during severe ketosis and following recovery will be presented.

P9. A Study of Normal Variations of Acetone Bodies in the Blood and Urine of Dairy Cattle. C. B. KNODT, University of Connecticut.

Various groups were set up composed of 12 mature cows, 9 twelve-month old heifers, 4 calves at birth, and 1 aged bull. Variations in relation to stage of lactation, stage of gestation, season of year, time of day, age, parturition, stage of oestrous cycle, total acetone body excretion for 8 to 24 hour periods, and effect of complete cessation of milking were studied.

All samples for blood and urinary acetone bodies were obtained when the animals were apparently normal in every respect. Analyses were deter-

mined immediately after samples were taken so as to minimize as much as possible the changes which occur. Blood was obtained from the jugular vein and potassium oxalate was used as the anticoagulant. Acetone bodies were determined by the method of Barnes and Wick (J. Biol. Chem., 131, 413, 1939).

Analyses on mature cows, calculated as acetone, consisted of 414 determinations for blood acetone and acetoacetic acid (Ave. 1.15 mgms. per cent), 436 determinations for total blood acetone bodies (Ave. 2.78 mgms. per cent, Min. .31, Max. 6.27), 369 determinations for urinary acetone and acetoacetic acid (Ave. 4.64 mgms. per cent), and 408 analyses for total urinary acetone bodies (Ave. 11.70 mgms. per cent, Min. .61, Max. 31.38).

A total of 64 analyses of non-pregnant heifers 12 to 22 months of age for blood acetone and acetoacetic acid (Ave. 0.91 mgms. per cent), for total blood acetone bodies (Ave. 2.03 mgms. per cent), urinary acetone and acetoacetic acid (Ave. 4.81 mgms. per cent), and total urinary acetone bodies (Ave. 13.24 mgms. per cent) calculated as acetone.

Fifty-nine blood analyses, calculated as acetone, on heifer calves from birth to seven months of age averaged 0.70 mgms. per cent acetone and acetoacetic acid, and 1.30 mgms. per cent total blood acetone bodies. An average of 55 urine determinations on this group was 2.54 mgms. per cent acetone and acetoacetic acid, and 4.86 mgms. per cent total urinary acetone bodies. Seven analyses immediately after the completion of parturition averaged 2.54 mgms. per cent total blood acetone bodies for the dam and 1.43 mgms. per cent for the calf.

P10. Glucose Therapy in Ketosis in Cattle. J. C. Shaw and Ross C. Powell, Jr., University of Connecticut.

The intravenous injection of glucose in most cases of severe ketosis usually produces a small decrease in blood and urinary acetone bodies for a few hours followed by a rise in acetone bodies often back to the previous level. Pumping from 6 to 10 pounds of glucose into the rumen by means of a stomach tube results in a much greater rise in blood glucose over a longer period of time and causes a marked fall in blood and urinary acetone bodies. In several cases the blood acetone bodies in severe ketosis decreased from a level of 30 to 60 mg. per cent to 3 to 4 mg. per cent within 24 to 48 hours. However, it was found necessary in all cases where the ration was not changed to continue some type of sugar therapy at a rather high level for several weeks. In those cases where the animal had a fairly good appetite it was possible to alternately cure and then reproduce severe ketosis merely by feeding three pounds of glucose per day for a few days followed by removal of glucose from the ration. In most cases of severe ketosis, however, it was found necessary to administer glucose in some other way, usually by

stomach tube, because of the difficulty involved in getting the animals to eat any kind of sugar or molasses.

Blood glucose values in 6 cases of severe ketosis ranged from 15.0 to 30.5 mg. per cent while blood acetone bodies ranged from 23.3 to 70.0 mg. per cent. Blood lactic acid was also low in most cases of severe ketosis ranging from 2.5 to 7.0 mg. per cent. Following the pumping of glucose into the rumen of the ketosis cow there is usually an increase of from four to five fold in the blood lactic acid in from 8 to 30 hours, probably due to the sudden oxidation of large quantities of glucose by the body tissues. The blood lactic acid value at this time often exceeds normal by 200 to 300 per cent.

Data on blood and urinary acetone bodies and blood glucose and lactic acid in ketosis cows and the effect of glucose therapy upon these substances will be presented.

P11. Progress Report on the Relation of the Ration to the Composition of Milk. E. B. Powell, Ralston Purina Company.

In November, 1938 and in June, 1939, progress reports were submitted at the American Society of Animal Production in Chicago and at the Dairy Science meeting at Pullman, Washington.

Early work indicated a correlation between rumination and butterfat test. Rumenless cows might throw some light upon this subject. At the June 1939 Dairy Science meeting, reference was made to the removal of the rumen from several calves. Three of these completely recovered, but as they developed, their rumens were regenerated, with one possible exception.

We again turned our studies to cows in production. To date, we have used 51 cows for 99 lactations. Recently we have confined our studies mostly to the effect of rumination and fermentation on the fat percentage. Twenty-two cows, mostly Holsteins, whose roughage was reduced to 6 pounds of normal alfalfa per head per day with concentrates full fed, showed the usual decrease in fat content of the milk. This decrease persisted as long as this method of feeding was continued, even throughout the entire lactation.

Believing that the contents of the rumen of these cows were abnormal, three cows after showing the typical decrease in fat content, were fed their usual concentrate, wetted and fermented with small quantities of rumen material taken from normal cows at time of slaughter. These cows all responded with an average increase of approximately 1 per cent in fat.

In order to determine if it was necessary for feed to go through a normal rumen before it would be effective, we placed several typical cows on the usual concentrate after it had been fermented for 48 hours. These cows all showed an increase in fat content of the milk thus proving that rumination was not essential.

Method of fermentation: The concentrate was saturated with tap water,

incubated at room temperatures ranging from approximately 100° to 110° Fahrenheit. The average relative humidity in this room was 49 per cent. The material was stirred daily at 4 A.M., 7 A.M., 10:30 A.M. and 4:30 P.M. After 48 hours of fermentation it was full fed to the cows in place of their dry concentrate.

Is fermentation essential? Four cows that had shown the usual decreased fat, received this same concentrate wet, but unfermented. These cow all continued with the low fat tests. This indicated that fermentation was necessary to cause the increased fat content.

The feeding of dry barley malt, butyric acid, and corn sugar mixed separately with the usual concentrate, was tried. Barley malt failed to show consistent increase in fat, while the other two mixtures showed no response at all. Although we have eliminated some factors and are narrowing the problem, we still do not have the solution.

What factor or factors are produced in a normal functioning rumen, or by fermentation? When we know the answers, we believe we will discover one or more of the at present unknown essentials for the production of normal milk and for normal reproduction.

P12. The Influence of Frequency of Milking on Milk Production. L. M. LUDWICK, ARLESS SPIELMAN AND W. E. PETERSEN, University of Minnesota.

As a means of evaluating the influence of frequency of milking on total milk yield, production of the right and left halves of the udder were recorded separately. Thus one half can serve as a check on the other.

Five mature Guernsey cows were used in the experiment. The experimental milkings covered a period of five months. In order to establish a basis for comparing the production of the two halves, preliminary milkings of each half were conducted which covered a period of ten days. The mean production for each half was established and then the frequency of milking was increased from two to three times a day, alternating halves at two-week intervals.

By comparing the records of the halves for the respective frequencies of milking, it was found that three-time-a-day milking had considerable advantage over two-time-a-day milking. Although none of the cows were in heavy lactation, the increase due to one additional milking per day was as high as 16 per cent.

It was also observed that the first half which was milked three times a day seemed to continue at a relatively higher level of production even after twice-a-day procedure was resumed.

This proposed method of using one half of the udder as a check on the other may be of value in experiments regarding milk production where it is desirable to eliminate environmental factors and individual differences.

P13. The Chlorine Tolerance of Certain Mastitis Bacteria. R. K. WAUGH, P. R. ELLIKER, J. H. HILTON AND J. F. BULLARD, Purdue Agricultural Experiment Station.

An attempt has been made to control mastitis in one of the University dairy herds by a sanitary procedure involving the use of chlorine solutions. The procedure consisted of washing the cows' udders before milking with individual cloths saturated with a solution containing 400 p.p.m. available chlorine, rinsing the teat cups of the milking machines between cows in a solution containing 200 p.p.m. available chlorine, and dipping the teats of the cows in a solution of 400 p.p.m. available chlorine after milking.

Experiments were carried out in the laboratory to determine whether or not the chlorine tolerance of certain mastitis organisms was low enough to warrant such a procedure. Also, the efficiency of the chlorine solutions in removing mastitis organisms from the teats was determined. The stability of chlorine solutions in actual use in the barn likewise was determined.

The chlorine tolerance of the respective organisms was determined by exposing standard suspensions to known concentrations of chlorine. Because of the addition of small amounts of milk to the chlorine solutions in actual use in the barn, some trials were run with chlorine solutions containing one per cent skim milk. When milk was added, the concentration of available chlorine was determined after adding the milk and the chlorine solution was then used immediately. One cc. quantities of the standard suspensions of the respective organisms were placed in 99 cc. of the respective chlorine solutions, and, after 20 seconds exposure to the chlorine, one cc. quantities were transferred to sterile N/10 sodium thiosulfate dilution blanks. Then plate counts were made and percentage survivals determined. The source of chlorine was a commercial calcium hypochlorite.

It was found that strain 090 of *Streptococcus agalactiae* would not survive an exposure to five p.p.m. available chlorine for 20 seconds. When one per cent skim milk was added to the chlorine solution, the tolerance of the organism was between 30 and 40 p.p.m. available chlorine for 20 seconds. A similar chlorine tolerance was shown by an alpha type hemolytic streptococcus isolated from a chronic case of mastitis. A strain of *Staphylococcus aureus* isolated from an acute case of mastitis showed considerable resistance to chlorine. With one per cent skim milk in the chlorine solution, 2.3 per cent of the staphylococci survived 600 p.p.m. available chlorine and 16.3 per cent survived 475 p.p.m. available chlorine for a period of 20 seconds.

Where no skim milk was present in the chlorine solution, the staphylococcus was killed by 100 p.p.m., but not by 50 p.p.m. of available chlorine during a 20 second period of exposure. Attempts were made by means of chlorine solutions to kill mastitis streptococci on the teats of cows after inoculation of the surface of the teats with suspensions of the organisms. Despite the low chlorine tolerance of the mastitis streptococci, these organisms could

be recovered from the teats after dipping in a solution containing one per cent skim milk and 400 p.p.m. available chlorine. However, fewer organisms were recovered and the recovered organisms showed less activity when 400 p.p.m. available chlorine rather than 200 p.p.m. available chlorine were used. When the same procedure was carried out with *Staphylococcus aureus*, the chlorine solutions appeared to have little effect upon these organisms.

A solution of calcium hypochlorite was used for rinsing the teat cups of the milking machine between cows, and it was found that after milking 20 cows, the solution contained about 55 per cent of its original concentration of available chlorine. After dipping the teats of 20 cows, the chlorine solutions used contained about 90 per cent of their original concentration of available chlorine.

P14. Influence of Oat Juice Extract upon the Age of Sexual Maturity in Rats. E. T. Gomez, A. M. Hartman and L. P. Dryden, Bureau of Dairy Industry, United States Department of Agriculture.

It has been reported by us (Proc. Am. Soc. Biol. Chem., 1941 meeting) that the juice of young oat plants contains a material which when fed to rats from weaning (21–22 days of age) produces early vaginal opening and stimulates early ovarian activity. The material is precipitated from the oat juice with alcohol. This precipitate has been found active when fed at 2 to 10 per cent of the ration. The average age of vaginal opening of 37 rats fed this precipitate is 29.5 days and 37 litter mate controls not fed the precipitate 45.3 days. Sixteen of 17 experimental rats autopsied showed evidence of stimulation of ovarian activity. The activity of these extracts was not due to the ash in them.

In the above work it was noted that the rats fed ad libitum on the experimental ration generally consumed up to the time of vaginal opening more feed than litter mates on the basal ration during the same time. Paired feeding trials have now been conducted to determine whether or not the effects of the oat juice precipitate noted above, are due to the increased food consumption.

Five pairs of rats were used in this experiment. The oat juice precipitate was fed at 4 per cent of the ration. The feed consumption of the animals fed the oat juice precipitate was in each case a little lower, up to the time of its vaginal opening, than was the consumption of their paired litter mate controls during the same time (0.5 to 4.2 grams less for the period of feeding), but in every case the vagina of the animal fed the oat juice preparation opened before that of its paired litter mate, in fact the vagina of every animal receiving the experimental ration opened before any of the controls. There, therefore, appears to be a specific material in the juice of

the young oat plants that stimulates vaginal opening and ovarian activity. A similar material also appears to be present in milk.

P15. The Effect of a High and a Low Protein Ration on the Gonadotropic Content of Male Rat Pituitaries.* E. J. WEATHERBY AND R. P. REECE, New Jersey Agricultural Experiment Station.

An assay method was developed whereby it was possible to estimate the gonadotropic content of a single male rat pituitary gland by observing its influence on the ovaries of sexually immature rats.

Twenty-two mature male rats were paired according to body weight and age. A 30 per cent protein ration was fed to one member of each pair while a 15 per cent protein ration was fed to the other member. The feeding period lasted from 28 to 62 days. Paired rats were always sacrificed on the same day, their pituitary glands removed and assayed for their gonadotropic content.

Pituitary glands from rats fed a high protein ration contained slightly more gonadrotropic hormone than did the glands from rats fed a low protein ration. The difference, however, was not statistically significant.

P16. The Evaluation of Fertility in Dairy Bull Semen.† H. A. HERMAN AND ERIC SWANSON, University of Missouri.

In this investigation the physical and chemical characteristics of 342 semen ejaculates, secured from 51 dairy sires by means of the artificial vagina, have been studied and the findings correlated with the actual breeding record of the bull. Characteristics studied included volume, initial motility, pH, survival time in storage (both diluted and undiluted) at 40° F.; spermatozoa per cu. mm., and morphological abnormalities of the sperm.

The semen was found to vary widely in all properties studied, though variations in initial motility and pH were of somewhat lesser nature. The greatest variations occurred in the length of time vigorous motility persisted and in percentage of abnormal spermatozoa.

Morphological abnormalities of the sperm were found in every sample of semen studied and ranged from 2 to 74 per cent of the total spermatozoa. Bulls which produced semen averaging over 30 per cent abnormal spermatozoa were usually of poor fertility, but not all samples of semen containing 30 per cent abnormal sperms were infertile. The most frequent types of abnormalities of the spermatozoa found were coiled tails, tailless, and pyriform. Usually the bulls showing a preponderance of coiled tail spermatozoa were of low fertility.

* Journal Series Paper of the New Jersey Agricultural Experiment Station, Rutgers University, Department of Dairy Husbandry.

† Contribution from the Department of Dairy Husbandry, University of Missouri Agricultural Experiment Station Journal Series No. 738.

Semen of high pH, 7.00 or higher, was usually of low viability. Semen poor in initial motility likewise survived only a short time after collection. As a rule normal pH, strong initial motility, and a low percentage of abnormal spermatozoa were an indication, but not assurance of good fertility.

Fertility of good quality semen was maintained 3 to 6 days when stored at 40° F. The ratio of services per conception for each bull has been determined and the summarized results will be presented.

It is believed that the fertility of a bull cannot be accurately estimated from a single semen sample using the criterions now in common use. Three or more semen samples examined several days, or even weeks apart, with accompanying records of the bull's actual breeding record, provides the most accurate method for evaluating fertility.

P17. The Effect of Exercise on the Amount and Quality of a Dairy Bull's Semen. O. L. Lepard, C. Edmund Shuart and Arden Foster, New Jersey Agricultural Experiment Station.

With the introduction of artificial insemination on a unit basis, it became necessary to produce semen of the highest possible quality. Exercise is known to aid in keeping bulls in a healthy and vigorous condition. It was the purpose of this investigation to determine the immediate effect of exercise on the amount and quality of semen.

Eight bulls, varying from two to five years of age, were divided into two nearly equal groups according to their age, weight and previous breeding records. All animals were fed and managed similarly and in a normal way except for exercise.

During the first four weeks, all bulls were tied in stalls. At the end of this four weeks period, and for the remainder of the sixteen weeks' experiment, four of the bulls were put on a mechanical exerciser for forty minutes each day. The other four bulls were left tied in the stalls.

Semen (two ejaculates) was collected by means of a standard artificial vagina. These samples were examined for concentration, and smears were made for morphological studies. The semen was then mixed with egg yolk dilutor and used for artificial insemination where conception rate was followed. A portion was stored at 40° F. and motility was read daily at 100° F. until no motility was noted.

The volume of semen showed a slight but insignificant advantage to bulls receiving exercise. No significant differences were noted between the two groups in the factors of morphology, concentration of the sperm, and life of the sperm at 40° F. Conception rates of the two groups of bulls followed the same general trend. These results must not be interpreted as showing that exercise of bulls is of no value. They only show the value of exercise on the amount and quality of semen as determined by the well measurements for a sixteen weeks' trial.

P18. Some Factors Influencing the Reproductive Efficiency of Louisiana Herds. D. M. SEATH AND C. H. STAPLES, Louisiana State University.

An examination of the eleven-year reproductive history of the North Louisiana Experimental (Bangs-free) Herd revealed a relatively low breeding efficiency and stimulated interest in studying the breeding records of the Louisiana State University Herd located in south Louisiana.

When measured by services per conception, the Experimental Herd averaged 2.8 while the University Herd had the creditable lifetime average of 1.7 for 934 cows leaving the herd between 1923 and 1940. In spite of the difference in rate of conception, each herd had almost identical calving intervals, averaging between 13.5 and 14.0 months.

Seasonal differences in rate of conception were found for both herds. In each case the summer months required the most services per conception. The best record for rate of conception in the Experimental Herd was during the winter months and the fall months were second. The University Herd had a reverse in this order with the fall months first and the winter months second.

About one-half (18) of the first-gestation heifers in the experimental herd had an extremely low rate of conception, averaging 5.3 services per conception, while the others (22) average only 1.4 services per conception. A similar division took place for the second-gestation group. These two groups of young cows with low-breeding efficiency contributed much toward the poor reproductive history of the herd.

Within the University Herd 65.7 per cent of the conceptions resulted from a single service, 18.2 per cent from two, 8.4 per cent from three, 4.1 per cent from four, and 3.6 per cent from five or more. As the number of services increased from one to five, the calving interval increased by six months.

Differences in breeding efficiency were found as between years, sires and dams within each of the herds. Natural soil fertility and annual rainfall favored the production of pasture and cultivated crops in the southern regions of the state thus suggesting a possible explanation for the differences found in the breeding efficiency of the two herds studied. The fact that each herd had the lowest breeding efficiency during the summer months suggests the influence of factors related to climatic changes.

P19. Progress Report on a Roughage Program in Herd Management. C. B. BENDER, New Jersey Agricultural Experiment Station.

High quality roughage is considered an ideal feed for dairy cattle. The quality, however, is dependent on many factors such as soil, fertilization, climate, plant source and the manner in which the roughage is preserved.

This study, covering a period of five years, involves a program of feeding

large amounts of grass silage of various kinds, pasture, and limited hay feeding, on the growth and productive ability of Holstein and Guernsey cattle. One hundred and fifty-nine milking animals and 216 heifers were included in the study.

Holstein milking cows were fed for the most part from 50 to 70 pounds of grass silage a day and the Guernseys received between 40 and 50 pounds depending on their size and ability to handle it. Hay consumption was limited to an intake of 6 to 10 pounds a day in addition. Grain was fed in proportion to production, the Guernseys being fed at the ratio of 1 : 3.5 while the Holsteins averaged 1 : 4 in the winter. During the pasture season, the bulk of the roughage was furnished by the pasture in the flush period. When pastures were short, grass silage or hay was supplemented.

Heifers at the age of 12 to 15 months were placed on an all roughage diet of either pasture, grass silage or a combination of grass silage and three pounds of hay. They continued on this diet until two months before freshening when they were finished off on grain.

All production records were made on twice-a-day milking; the lactations were divided into 305 days or over, and under 305 days. The milk production was calculated on a 4 per cent fat basis. For the growth data, the animals were weighed and measured every three months after they reached the age of 12 months.

This study shows that (1) normal production of milk seems to be maintained on this method of feeding; (2) the growth curves are slightly under Ragsdale standards for height and heart girth. Weight normality drops as low as 85 per cent when the animals are 24 months of age and rises to 98 per cent when the animals are 3 years old. The heifers were fed timothy silage for the first three years and oats and peas silage for the last two years in the growth studies. Legume silage or a mixture of legumes and grasses was fed to the cows in production.

P20. The Approved Ayrshire Sire Program. C. T. CONKLIN, Ayrshire Breeders' Assn.

The Approved Ayrshire sire plan, based on the results of some ten years of personal study on the part of Leonard Tufts of Pinehurst, North Carolina, was adopted on November 15, 1940 by the directors of the Ayrshire Breeders' Association, and is now a service furnished to Ayrshire owners.

The first step in the study of a sire is to list in the order of birth all registered daughters three years old or over, regardless of whether or not they have been tested. Every effort is made to make certain that every daughter of a sire that has freshened in a herd that is on test is included in this study. Sires are not approved when the data show that the tested daughters are a selected group.

All records are computed to a mature equivalent, 305-day lactation basis

on two milkings daily by the use of standard factors approved by the Bureau of Dairy Industry, United States Department of Agriculture. An Ayrshire sire is considered approved when he meets the following requirements, with all records computed to a mature equivalent, 305-day lactation basis:

1. A comparison of a complete sample of at least ten daughter-dam pairs, but including all daughters from tested dams.
2. All tested daughters must average at least 8500 lbs. milk or 340 lbs. fat with an average butterfat test of not less than 3.9 per cent.
3. Sire must have an equal parent index of not less than 8500 lbs. milk or 340 lbs. fat and a butterfat test index of not less than 3.9 per cent.
4. Not less than 70 per cent of all the tested daughters must each make 8500 lbs. milk or 340 lbs. fat.

Although this method of analyzing the transmitting ability of dairy sires may seem rather complex, it is believed that each of the above requirements is essential.

P21. Some Chemical Determinations Useful in Silage Studies. A. E. PERKINS, Ohio Agricultural Experiment Station.

Among the changes which occur in green plant material in the process of silage making probably the most obvious is the disappearance of sugars and the production of acids. This, however, is only one of the many chemical changes which occur. The nature and extent of these changes largely determine the quality of the resulting silage.

Aside from the conventional cattle feed analyses, which certainly do not supply adequate information, the worker is largely "on his own" since there seem to be no well developed or standardized procedures, for tracing the progress and nature of chemical changes which occur during silage making. There is presented here a description of certain determinations which have been found useful in this connection. It is well realized that the field has not been fully covered and that perfection has not been attained in any case.

Dry Matter. This determination is always included since we regard dry matter control as probably the most important single factor in determining silage quality. A rapid and reliable method for making this determination has been found and described elsewhere.

Nitrogen Separations. The proteins and related nitrogenous compounds as well as the sugars undergo marked changes during silage making. The series of determinations outlined here gives a fair idea of the extent and character of these changes.

The samples examined in the cases of both the crop and the silage include:

a. The entire material.
b. The expressed juice or a 4:1 water extract in the case of samples too dry to yield juice.

c. The filtrate from (b) after adjusting acidity and heating to coagulation.

Total Nitrogen determinations are conducted on (a), (b), and (c). Ammonia determinations (aspiration technique) are conducted on (b) and (c). The ammonia determination in silage is of especial significance since it seems to correlate closely with the quality of the silage. Amino Acid determinations are conducted by the Sorenson Formal Titration method on (b).

Titration Curve. Replacing and amplifying the determination of pH and titratable acidity, titration curves are now made on (b) which are thought to provide additional valuable information.

Acids. A disagreeable, penetrating, and persistent odor found in some silages particularly that made from very wet material is frequently attributed to butyric acid. The exact extent to which butyric acid replaces acetic acid in the volatile acid fraction of the silage acids in such cases has not been thoroughly studied. Methods heretofore used for the separate determination of the individual acids occurring in silage are cumbersome and unsatisfactory.

Studies are under way and some progress has been made toward simplifying the methods.

P22. Corn Meal as a Grass Silage Preservative. G. Bohstedt, W. H. Peterson, and G. P. Bahler, University of Wisconsin.

More than 20 years ago in several experiments ground corn grain was used with fair success in the preparation of legume silage. Meanwhile corn has become almost forgotten as a grass silage preservative. It has seemed that compared with a more readily fermentable carbohydrate like sugar or molasses, or compared with phosphoric acid or the A.I.V. acid mixture, ground corn was a less logical preservative. But recent tests at the Wisconsin Experiment Station have indicated that rather effective preservation may be obtained provided enough ground corn is added. It appears that a larger proportion of the starch of corn grain is converted to preservative acids than has heretofore been thought to be the case. If then corn has at least fair preservative properties, a farmer with corn on hand at the time of grass silage harvest may save out-of-pocket cash that is necessary for buying molasses or acid.

The Wisconsin experiments conducted during the past 3 years have included corn meal-alfalfa silages put up in bottles, barrels, and as 5 to 10 ton layers of silage in tower silos. Samples were analyzed for pH, carotene, and in a number of cases for NH_3–N. Where corn meal-alfalfa silage had been fed for a considerable time to milking cows, the milk was analyzed for carotene and vitamin A. The total vitamin-A potency of the milk was found to be about equal to that of milk from molasses-alfalfa silage.

When less than 120 pounds ground corn was used for a ton of green alfalfa, the quality of the resulting silage as based on appearance, odor, and chemical analysis was only fair. Adding 2 pounds of sulphuric acid to the limited amounts of corn per ton of alfalfa gave much better preservation of carotene.

From 150 to 200 pounds ground corn as a preservative for alfalfa silage gave rather good results in all of the above aspects, and compared in its effect with 60 pounds of molasses. An outstanding effect of ground corn as a preservative was the improved palatability of such alfalfa silage as compared with alfalfa silage produced in various other ways. It is suggested that shelled corn or ear corn which is to be used as a preservative, be ground rather fine.

P23. Trench Silos for Preserving Cereals Treated with Molasses, or Phosphoric Acid.* H. A. HERMAN, A. C. RAGSDALE AND WARREN HEATHMAN, University of Missouri.

Dairy farmers frequently desire to store cereals, often grown as pasture or cover crops, in temporary silos. Previous experience at this Station and in field trials had demonstrated that the "paper sack" or "snow fence" type of silo was not too well suited for this purpose because of excess spoilage during the summer months. We, therefore, in the summer of 1940, conducted trials using trench silos for barley.

Two trench silos, with a capacity of 45 to 50 tons each, were used. The silos were located on a well drained hillside. The walls of the silos were 12 feet apart at the top and 8 feet at the bottom of the trench. Each silo was filled one-half with chopped and one-half with unchopped barley bundles. The barley was cut in the milk stage.

One of the silos was filled with barley silage treated with 60 pounds of blackstrap molasses per ton. In this silo 32.15 tons of barley was chopped into ½ to 1″ lengths, and stored at one end of the silo. In the opposite end 20.12 tons was stored unchopped. A binder was used for harvesting the green barley and the bundles were put into place in stack fashion. Each layer was treated with blackstrap molasses.

In the second silo 26.04 tons of chopped barley, treated with 8 lbs. of 75 per cent phosphoric acid per ton, was placed in one section. The remaining space was filled with 19.05 tons of bundles and treated with acid at the same rate as the chopped barley.

The silos were sealed and precautions taken to prevent surface water from draining into the pits.

Six months after filling, the silos were opened and the contents fed to cows in milk and also to growing heifers. The spoiled portions, as well as

*Contribution from the Department of Dairy Husbandry, University of Missouri Agricultural Experiment Station Journal Series No. 737.

the good quality silage, was weighed from each silo. The palatibility and relish with which the cattle ate the silage was carefully noted. Only good quality silage was offered the animals.

The losses through spoilage in terms of fresh silage were as follows:

1. Chopped barley—molasses treated 16.90% spoilage
2. Barley bundles—molasses treated 26.5 % spoilage
3. Chopped barley—phosphoric acid treated 14.32% spoilage
4. Barley bundles—phosphoric acid treated 15.22% spoilage

With the exception of bundles treated with molasses the rate of preservation for a temporary type of silo was apparently satisfactory. Earlier studies have shown losses of 13 to 28 per cent of the total silage made from corn when using permanent silos. The greater spoilage in the molasses treated bundles was largely due to mold growth and excess fermentation no doubt as a result of inability to secure sufficient packing in this type of silo so as to exclude air. The phosphoric acid silage made from bundles was preserved nearly as well as the chopped barley.

A short feeding trial using the reversal method with 8 cows of equal weight and producing ability indicated no significant difference in the palatability of the two silages, although if any difference the cows ate the molasses silage most rapidly. The groups receiving molasses silage averaged approximately one pound more milk per day, but this difference was not considered significant.

Analyses of the fresh barley have been made, and analyses of the silages are under way in an attempt to measure losses in nutrients.

These trials indicate that trench silos built and filled according to the best practices may be satisfactorily used for ensiling chopped cereals treated with either molasses or phosphoric acid. Where unchopped cereals are ensiled care must be used to insure proper packing to prevent excess spoilage.

P24. Calculating Pasture Yields with Dairy Heifers as Experimental Animals. H. B. Morrison and Fordyce Ely, Kentucky Agricultural Experiment Station.

Data are reported from five years (1936–1940, inc.) experimental grazing of bluegrass pastures on which Jersey and Holstein heifers were used. Half of the pasture was grazed continuously throughout the season and the other half was divided into two equal portions which were pastured alternately for two week periods while the grazing season lasted. Heifers for the experimental pastures were allotted on the basis of age, breed, breeding, weight, height at withers, and nearness to figures for normal weight and height as published by the Missouri Agricultural Experiment Station (Bul. 336, 1934). All heifers were weighed on three consecutive days in alternate weeks and from these weights were computed the gains or losses and the weight of the heifers maintained daily per acre on the pastures throughout the season. The figures obtained for gain or loss are converted into terms

of T. D. N. on the basis of the recommendations of the pasture research committee of the A. D. S. A. (Rev. of Mimeo. Circ. 1046, U. S. D. A., Soil Cons. Serv., June 1940), 3.53 pounds T. D. N. per pound gain in weight and 2.73 pounds T. D. N. per pound loss in weight. The average weight of all (94) of the heifers involved (624 lb.) was used as a guide in calculating the T. D. N. for maintenance. Based on data from "Feeds and Feeding" (Henry & Morrison) approximately 4.65 lb. T. D. N. daily is required to maintain a 624 lb. heifer.

The "Bluegrass equivalent," a term used to give an approximate figure for pasture yield, is calculated from the total T. D. N. for maintenance and gain, using the figure given for T. D. N. for bluegrass (all analyses) in "Feeds and Feeding."

P25. A Study of the Relationship of Fat Content in the Dairy Grain Ration to Milk and Butterfat Production. C. F. MONROE AND W. E. KRAUSS, Ohio Agricultural Experiment Station.*

In a series of four feeding trials two grain mixtures containing different amounts of fat have been compared. These grain mixtures were alike except for the protein supplement used and were composed of such common feeds as corn, oats, wheat bran, beet pulp and molasses. Ground soybeans and expeller soybean oil meal were used in the higher fat mixture, and extracted soybean oil meal in the lower fat mixture. The former mixture contained, approximately, 4.5 per cent fat and the latter 3.0 per cent fat.

In three of the trials to be reported the feeding program has consisted of a preliminary period of 30 days and an experimental period of 100 days. The roughage feeding in these three trials has consisted of fair to good quality clover or alfalfa hay and corn silage. The hay has been fed *ad libitum* and the corn silage at the rate of 30 pounds per day. In a fourth trial, the amount of roughage fed was calculated to satisfy maintenance, and sufficient grain was fed to furnish 80 per cent of the theoretical T.D.N. requirement for milk production. During the preliminary period all cows have received the same grain mixture consisting of a 50–50 blend of the experimental mixtures indicated above.

Of the two trials completed at the time of writing this abstract, one has shown an advantage for the higher fat mixture, whereas in the other the results are practically equal.

The remaining two trials will be completed and the results will be available by the time of the meeting.

P26. The Influence of Sustained High Fat Intake upon Milk Fat Production. N. N. ALLEN AND J. B. FITCH, University of Minnesota.

Large increases in fat intake of dairy cows by addition of any of a num-

* In cooperation with the Ohio State Department of Public Welfare and the Central Soya Company, Inc., Fort Wayne, Indiana.

ber of common fats have been shown to cause an immediate increase in the fat content of the milk and in milk fat yield, but the influence of continued high-fat intake has not been demonstrated.

In 1939 the influence of six different fats, including butterfat, lard and linseed, coconut, soybean and corn oils, fed at a level of 1.5 pounds daily over fifty-day periods was studied in comparison with a ration similar in every respect except that 3.4 pounds of a mixture of equal parts of cornstarch and sucrose replaced the fat. Two cows in early lactation and as nearly matched as possible for productive level were used for each of the fats. The reversal plan was followed with each pair of cows.

The cows receiving butterfat and lard showed decidedly higher test and milk fat production during the period of high-fat intake than during the period of low-fat intake. Slight increases were observed with linseed and coconut oils and marked decreases for soybean and corn oils. A similar trial was carried out in 1940 using butterfat, lard, tallow and coconut, cottonseed, peanut, soybean and corn oils.

The fat content of the milk and the yield of milk fat were markedly higher during the period of high-fat intake with butterfat, lard, tallow and coconut and cottonseed oils, and slightly higher with peanut oil. With soybean oil the test was slightly lower. With corn oil pronounced decreases in both test and fat yield were observed.

With all fats except the soybean and corn oils the results are in agreement with those observed previously with five-day periods. The stimulating influences appeared to be exerted throughout the fifty-day periods, although greatest immediately after the change of rations.

With soybean oil and with corn oil the sustained effect seemed to be in direct contradiction to that previously noted over five-day periods. Comparing the production for the five days immediately preceding and following the change of fat intake, it was found that the test was higher in the high-fat period with soybean oil. With corn oil the test was slightly lower when the oil was fed, but the depressing effect was not as great as that observed with continued feeding. This suggests the presence of a depressing agent in the corn oil and possibly in the soybean oil which is slow in exerting its influence to the point of overcoming the stimulating influence which other constituents of the fat might be expected to have. Further work is being carried out with a greater number of cows to determine whether this depressing action is characteristic of corn oil and to determine the causative factors.

P27. The Relation on Mineral Intake and Sunshine to the Vitamin D Deficiency of Mature Dairy Cattle. G. C. WALLIS, South Dakota Agricultural Experiment Station.

In continuing our studies on the vitamin D deficiency of mature dairy cattle we have now accumulated considerable evidence as to the relation of

the level of calcium and phosphorus intake to the development of vitamin D deficiency symptoms. Two methods of approach have been used, namely: (1) the development of vitamin D deficiency symptoms on a ration supplying a normal mineral intake with subsequent addition of liberal amounts of calcium and phosphorus to note curative effects, if any, and (2) the feeding of vitamin-D-deficient rations supplying two or more times the normal amount of calcium and phosphorus to see if deficiency symptoms would develop. Detailed evidence has been obtained including observations on the physical condition of the animal, the level of calcium and inorganic phosphorus in the blood plasma, the concentration of vitamin D in the blood plasma and butterfat, and on mineral balance trials. The combined evidence indicates that generous amounts of calcium and phosphorus in vitamin D deficient rations will not prevent the development of deficiency symptoms in dairy cows. Neither will the addition of calcium and phosphorus to the ration of animals exhibiting evidence of vitamin D deficiency relieve that condition.

Observations of a similar nature have been made on other cows while deficiency symptoms were developing and after exposing such vitamin D deficient animals to the antirachitic effects of sunshine. Certain cases studied during the late fall and winter are essentially significant in giving direct evidence of the antirachitic effectiveness of sunshine at this season of the year. In this experiment a direct attack on the problem has been made in that the cows were first depleted of vitamin D reserves so that conditions were optimum for noting any possible effects of sunshine exposure. The evidence indicates that mature dairy cows respond favorably to the antirachitic effects of sunshine in a manner similar to that which has already been demonstrated for calves. Also, that the vitamin D potency of the butterfat produced may be increased by this means.

P28. Observations on the Quantitative Requirement of Mature Dairy Cattle for Vitamin D. G. C. WALLIS, South Dakota Agric. Experiment Station.

The quantitative requirement of mature dairy cows for vitamin D becomes a question of some significance now that it has been demonstrated that normal health and vigor cannot be maintained without it. Studies under way at this station on the vitamin D deficiency of dairy cows have already given some information on this problem. Five different cows showing various degrees of vitamin D deficiency have been given known amounts of vitamin D usually in the form of a limited quantity of alfalfa hay of known vitamin D content. The results have been measured in terms of the amount of vitamin D required to initiate healing and the rapidity and degree of the resulting recovery. Observations on the physical condition of the animal, changes in the concentration of blood plasma calcium and inorganic

phosphorus, the vitamin D in the blood plasma and butterfat, and mineral balance trials have contributed to the interpretation of the results.

An idea of the magnitude of the requirement is indicated by the fact that in one case 2 pounds of alfalfa hay sufficed to bring about marked improvement in the physical condition of a vitamin D deficient cow and bring the blood plasma calcium and inorganic phosphorus from very low levels to normal concentrations in about four weeks' time. The available data is now being tabulated for further study so that more definite conclusions will be available in the near future.

P29. Relation of Skeletal Reserves of Calcium and Phosphorus Laid Down During Growth to Persistence of Milk Production of Dairy Cows. L. S. PALMER AND T. W. GULLICKSON, University of Minnesota.

Two groups of seven pure-bred calves, each group represented by three Guernseys, two Holsteins and two Jerseys, were reared from weaning on rations which differed only in their calcium and phosphorus content and were continued through the first two lactation periods on rations which differed in a similar manner. The control group received liberal amounts of calcium and phosphorus; for three animals these averaged about 70 grams calcium and 30 grams phosphorus daily per 1000 pounds weight; for the remainder these averages were approximately 125 grams calcium and 35 grams phosphorus. For each control animal there was a corresponding experimental animal of the same breed which differed from it only in receiving in its grain mix enough steamed bone meal to double the phosphorus intake. After calving the calcium and phosphorus intakes of the control animals were determined largely by the grain intake commensurate with the milk production but the bone meal group received daily 100 grams of bone meal plus an additional 20 grams per pound grain fed. With one exception all animals were on official test for the first lactation and on herd ration for the second lactation; one animal in the bone meal group was on official test for both lactations. In general the bone meal group consumed approximately 150 grams bone meal daily throughout the entire experiment.

Two grade calves, one in each group, were reared to the age of 28 months but not bred. Bone composition studies showed heavy deposits of calcium and phosphorus which were slightly greater for the bone meal fed animal. Bone analyses of one of the latter group of pure-breds after her second lactation showed that the heavy deposits of calcium and phosphorus had not been impaired.

A study of blood plasma calcium and inorganic phosphorus at monthly intervals throughout the entire study showed that the phosphate concentration was definitely higher up to the first parturition for the bone meal fed heifers paired with the controls receiving the lower level of calcium and

phosphorus but this difference was not so striking, and in some instances not evident, in the other pairs. After lactation started the differences were not marked for any of the pairs.

There was no appreciable difference in rate of growth of the animals in the two groups but the bone meal fed animals seemed to have a somewhat better general appearance during this period. There were no differences in breeding capacity or in the incidence of difficulties attributable to the feeding or lack of bone meal. Actually eight animals were started in each group of pure-breds but one Holstein in each group could not be considered in the final results because of accidents not related to the experiment.

The effects of the bone meal feeding on persistence of milk production were judged on the fat-corrected milk basis both for 365 day (or less) lactations and on the complete lactation periods. At first sight the results seemed significant because the mean differences between the first and second lactations of the two groups were 1066 pounds for the 365 day lactations and 1642 pounds for the complete lactations, both differences being in favor of the bone meal fed group. However, the statistical P-values of these differences were only 0.28 and 0.32, respectively, indicating that they were not significant.

P30. The Effect of Feeding Chloretone (Trichlorobutyl alcohol) on the Blood Plasma Ascorbic Acid of Dairy Cattle. A. L. Bortree, E. C. Scheidenhelm, and C. F. Huffman, Michigan State College.

Chloretone which had been observed to increase ascorbic acid excretion in the urine of rats was fed at different levels for varied lengths of time to dairy cows and bulls and the effect on the plasma ascorbic acid observed.

Six cows which were open or in the early stages of pregnancy and one cow in the fifth month of gestation showed ascorbic acid levels within the normal range prior to the period of feeding chloretone. One open cow and two bulls were below this level.

One cow given a 40 gram dose of trichlorobutyl alcohol showed an increase in the plasma ascorbic acid the following day and a peak was reached on the seventh day. One open cow fed 10 grams daily showed an increase after five days of feeding and reached a peak on the ninth day; a cow in the fifth month of gestation did not respond to feeding chloretone at this level.

When three cows were fed at the five gram level the response was noted on the third day in two of the cows and on the fourth day in the third cow. The peak was reached on the same day that the response was noted in these three animals.

The levels of plasma ascorbic acid were appreciably increased in the two bulls which were fed 5 grams of chloretone per day.

When 5 grams of chloretone were fed per day the plasma ascorbic acid level increased about 50 per cent; when larger doses were given an increase

of approximately 100 per cent was observed. The ascorbic acid values returned to normal in about two weeks after the trichlorobutyl alcohol feeding was discontinued.

Five grams of chloretone per day for a period of 30 days had no noticeably bad effects on the animals but higher levels of feeding had an anesthetic effect accompanied by lowered milk production.

P31. Some Observations on the Carotene Content of the Blood Plasma of Dairy Cows. HAROLD GOSS AND S. W. MEAD, University of California.

In connection with studies on the relation of carotene to rancid flavor in milk, carotene values were determined on blood plasma of cows, (five Jerseys and one Guernsey) taken from pasture and placed on a low carotene diet consisting of bleached alfalfa hay, testing less than 0.05 mgm. of carotene per 100 grams, and concentrates of negligible carotene content. When the plasma carotene had fallen to a minimum level the cows received (1) fresh green alfalfa of known carotene content; (2) crystalline carotene dissolved in cottonseed oil, orally; (3) intrajugular injections of crystalline carotene suspended in blood serum; and (4) intrajugular injections of crystalline carotene dissolved in cottonseed oil.

The depletion of carotene in the blood of all of the cows while receiving bleached hay followed the same type of curve, with a very rapid fall during the first ten days. Although original blood plasma values varied from 0.90 to 2.30 mgm. per 100 cc. plasma these cows reached a constant value of 0.04 to 0.09 mgm. per 100 cc. blood plasma after 70 to 90 days respectively.

Oral administration of 250 mgm. daily of crystalline carotene in cottonseed oil caused only slight increases in the blood carotene level. Five hundred mgm. daily increased the level to 0.76 mgm. per cent from initial values of 0.05 to 0.08 mgm. per cent in a total of 41 days. Little increase beyond this value was noted with this level of carotene feeding, but when the intake was raised to 1000 mgm. daily for one cow the blood carotene level increased from 0.75 to 2.33 mgm. per cent in 54 days.

Two cows fed 24 pounds daily of fresh green alfalfa with an average value of 33.6 mgm. per pound as fed, or a daily intake of approximately 800 mgm. of carotene showed blood carotene values intermediate between two cows receiving respectively, 500 and 1000 mgm. daily of crystalline carotene in cottonseed oil.

Intrajugular injections of suspensions of from 400 to 900 mgm. of crystalline carotene in blood serum caused no detectable change in blood carotene in a cow whose blood carotene had been depleted to 0.04 mgm. per cent, as indicated by analyses of blood samples taken from the opposite jugular within two and one half minutes following injection and at 15 to 20 minute intervals throughout the day.

With a second cow an intrajugular injection of 250 cc. of cottonseed oil containing 1500 mgm. of crystalline carotene also failed to bring about a significant increase in blood carotene. Four days later a second similar injection of 1100 mgm. of carotene brought about no detectable increase in blood carotene. Analyses of the lungs, liver and body fat made four hours following the last injection of 1100 mgm. of carotene revealed large quantities of carotene in the lungs, relatively small quantities in the body fat and only a slight amount in the liver. Based on these analyses, the lungs alone had retained 1200 mgm. of carotene.

P32. Vitamin A Levels in the Blood Plasma of Dairy Cattle on Winter Rations and the Influence of Vitamin A Supplementation on Certain Constituents of the Blood. PAUL H. PHILLIPS, P. D. BOYER, H. A. LARDY, AND N. S. LUNDQUIST, University of Wisconsin.

The vitamin A, carotene, and ascorbic acid content of blood plasma was obtained from certain herds in three breeding cooperatives. Samples were taken in late October, January, and March or April. The cattle (both bulls and cows) were divided into controls and those receiving a high potency vitamin A shark liver oil for either 2 months or 5 months. Preliminary results indicate a sparing action on carotene, a tendency to maintain more nearly normal ascorbic acid values, and in the case of prolonged feeding to maintain an adequate blood plasma vitamin A.

P33. The Blood Plasma Vitamin A Content of the New Born Calf and Its Relation to Certain Calfhood Diseases. PAUL H. PHILLIPS, NORMAN S. LUNDQUIST, AND PAUL D. BOYER, University of Wisconsin.

The blood plasma vitamin A, carotene, and vitamin C analyses were made on the new born calf at birth and at varying intervals of 12, 24, 48 hours and several weeks after birth. Without exception the ascorbic acid was higher than average and in no case could vitamin A be found in measurable amounts before suckling. The ingestion of colostrum quickly brought the vitamin A and C levels to normal. The relationship of vitamin A to scours and allied ills of the calf will be discussed from data obtained from field experiments.

P34. The Carotene (Provitamin A) Requirements of Dairy Cattle for Lactation. A. H. KUHLMAN AND W. D. GALLUP, Oklahoma A. and M. College.

Prairie hay has been used as the sole source of carotene in a study to determine the vitamin A requirements of dairy cattle for reproduction and lactation. Grade Jerseys have been fed prairie hay at levels which repre-

sent approximately a full, a fifty per cent and a twenty-five per cent normal hay allowance. Eighteen cows have completed thirty-four gestation periods.

When the average daily intake of carotene during the last ninety days before calving was forty or less micrograms per pound of body weight reproduction was quite likely to be impaired. Many of the calves born were very weak, and most of the cows developed abnormal conditions at or soon after the time of calving.

When prairie hay was the only source of carotene an average daily intake of from 40 to 45 micrograms of carotene per pound of body weight was about the minimum amount which met the requirements of Jersey cows for normal reproduction and the initiation of a normal lactation performance.

Preliminary results of twenty-two complete lactations of twelve grade Jersey cows indicate that the requirements of carotene for the function of lactation apparently do not exceed the requirements for normal reproduction. The lowest average daily intake of carotene for the entire lactation was 39 micrograms per pound body weight and the largest 239 micrograms. Carotene intakes during the gestation and lactation periods in excess of the requirements for normal calving did not increase milk and butterfat production of these grade Jersey cows, the butterfat yields of which did not exceed 400 pounds in 310-day lactation periods. Production was greatly reduced when a low carotene intake during the last three to five months of gestation was followed by difficulties at the time of parturition or impairment of vigor during the early part of the lactation period.

There are indications that if a lactation has proceeded in a normal manner for several months on a low but adequate carotene intake, the carotene intake may be reduced considerably lower than 40 micrograms daily per pound body weight for several months without apparently influencing yield adversely. This may mean that the carotene requirements are actually lower for lactation than for reproduction and also, that a higher carotene intake is required at the beginning of the lactation period than in the later months of the milking period.

P35. Further Studies of the Effects of Vitamin A Deficiency on Reproduction. S. L. HANSARD* AND T. S. SUTTON, Ohio State University, Ohio Agricultural Experiment Station.

Previous work has demonstrated that in male animals (rats and calves) suffering from avitaminosis-A, there is marked degeneration of the germinal epithelium of the seminiferous tubules and reciprocal pituitary changes. It was considered advisable to study further the relative extent of these changes when graded amounts of vitamin A were used to supplement a diet devoid of this factor.

* Now with the Agricultural Extension Service, University of Tenn.

Three groups of weanling male albino rats were placed on the U.S.P. vitamin A deficient ration. This ration was supplemented with graded dosages of vitamin A from Reference Standard Oil. The amount admintered was maintained at levels of 10, 20 and 30 International Units per kilogram of body weight. After approximately 66 days on this ration the experiment was terminated.

A histological examination of the testes revealed a close relationship between the degree of degeneration and the level of vitamin A intake. By this examination one could determine with striking accuracy the level of vitamin A intake of the animal from which the specimen was prepared. Some evidence of degeneration was noted in the testes of animals receiving 30 I.U. of Vitamin A per kg. of body weight.

An assay of the anterior pituitaries for gonadotropic activity showed interesting differences between groups. The glands from the animals receiving 10 I.U. per kg. daily had the greatest gonadotropic activity per unit weight of pituitary tissue and those receiving 30 I.U. the least, with those on the 20 I. U. level, intermediate in this respect.

At the termination of the experiment the animals were killed by exsanguination and the blood collected for plasma ascorbic acid determinations. This was carried out by the 2–6 dichlorophenol indolphenol titration method. The animals on the 30 I.U. level had an average blood plasma ascorbic acid content of 0.896 mg. per cent, those receiving 20 I.U. per kilogram 0.737 mg. per cent and those receiving 10 I.U. per kg. had an average level of 0.587 mg. per cent.

The data obtained indicates that 30 I.U. of vitamin A per kilogram of body weight is not sufficient to protect the rat from degenerative testicular changes over a long period of time.

P36. Some Ocular Changes and Deficiency Manifestations in Mature Cows Fed a Ration Deficient in Vitamin A. L. A. Moore, Michigan State College.

Mature cows, fed a vitamin A deficient ration previously used with calves, failed to develop blindness due to constriction of the optic nerve as has been observed in calves. Papilledema was more difficult to develop in cows than in calves and failed to become evident in two out of six animals. This difference is probably explained by differences in intraocular tension of the two age groups. Once the papilledema develops it takes considerable time for it to recede.

Mature cows did develop nyctalopia, incoordination, and an edema of the legs on the vitamin A deficient ration. The tapetum nigrum and lucidum of the eye developed a mottled appearance.

When the plasma carotene values receded to a 0.2 to 0.5 microgram level deficiency symptoms usually followed in a short period of time. The fat

of a Guernsey cow which died with symptoms of vitamin A deficiency showed the presence of a pigment which was most likely carotene since it was epiphoric between petroleum ether and 92 per cent methyl alcohol.

MANUFACTURING SECTION

M1. The Role of Acid Cleaning Agents in Dairy Detergency. M. E. Parker, Beatrice Creamery Company, Chicago, Illinois.

The alkaline cleaning compounds have played an important role in dairy sanitation. Due to their inherent chemical properties, they have long been recognized as best adapted for practically all dairy cleaning practices.

Acid compounds have suffered by comparison because of their inferior detergency and particularly because of their corrosive action upon dairy metals. Recent development of an acidified steam rinse in the cleaning of milk cans indicated the desirability of acid type of cleaners due to the improved bacterial flora surviving such treatment. The use of acid cleaning agents possessing even enhanced detergency, the lack of any appreciable corrosion, the means for preventing as well as reducing milk stone deposits are all important and probably point to a revision—and incidentally a marked improvement—of dairy cleaning practices.

M2. The Value of Acidifying Milk and Cream Cans from the Standpoint of the Effect Upon Quality. Alvin Rippen and L. H. Burgwald, Ohio State University.

Experiments were conducted to note the effect of an acid reaction in milk and cream cans upon the bacterial flora. Acidification was accomplished by means of an acid ejector placed on the last steam jet of the can washer. One hundred cans acidified with about 0.63 per cent gluconic acid had a lower total bacteria count on whey and standard tryptone glucose skim milk extract agar than similar untreated cans. When 100 cc. of sterile water was added to the freshly washed cans and allowed to stand at room temperature for 24 hours, a pH of 5.0 or less markedly inhibited the development of proteolytic bacteria. Greatest numbers of proteolytic bacteria developed in cans having a pH near the neutral point. Little difference was noted in the total bacteria count after incubation. After two days at room temperature, the acidified cans had a better odor than the non-acidified cans.

Acidifying cream cans before returning to direct shippers did not show any significant improvement in the quality of the raw cream received. The titratable acidity of the cream was about 0.45 per cent. Little difference was noted in flavor and total bacteria count; however, cream received in acidified cans had a slightly higher yeast count. Proteolytic bacteria were often absent or present only in very small numbers in high acid cream.

Control samples of raw cream held at 40 to 45° F. and at 55 to 60° F.

showed no significant difference in the number of proteolytic bacteria and total bacteria count, irrespective of container reaction.

Sterile glass containers rinsed with distilled water were used to collect the milk which was added to treated and untreated cans. No noticeable effect of holding raw and pasteurized milk for 72 hours in acidified and non-acidified cans, either as to number of proteolytic or total bacteria, was observed.

Acidifying the cans with gluconic acid as done in these experiments had no detrimental effect upon the can.

Investigators have found butter samples to increase in phosphatase value during storage. Studies were made on creams held in both acidified and non-acidified cans and the butter made from them with respect to their phosphatase reaction. Cream was held in acid and non-acidified cans for one week at 45° F. and at 55 to 60° F., then pasteurized at 145° F. for 30 minutes. Samples of the creams held at 45° F. and at 55 to 60° F. from both types of containers showed no appreciable difference in the time required for the change in phosphatase activity. Samples of the resulting butter gave similar results. A decrease in the number of proteolytic bacteria in cream increases the time necessary to change the resulting butter from a negative to positive phosphatase reaction.

Bacillus subtilis, Achromobacter putrefaciens, Pseudomonas mephitica, and a proteolytic rod isolated from butter produced a positive phosphatase reaction in sterile milk. *Aerobacter aerogenes* was only slightly effective in causing a change in phosphatase results. No change occurred in sterile milk inoculated with *Escherichia coli, Chromobacter viscosum, Proteus vulgaris, Streptococcus liquefaciens, Lactobacillus bulgaricus, Lactobacillus acidophilus, Pseudomonas fragi,* and several others isolated from butter (when using Gibbs reagent).

M3. The Bacteriological Spoilage of Milk Held Near the Freezing Point.

J. M. Sherman, G. M. Cameron and J. C. White. Cornell University.

Inasmuch as our information on the growth of bacteria and the spoilage of milk when the milk is held barely above the freezing point is based on experiments conducted more than thirty years ago on raw milk, it seemed possible that there might be some additional points of interest revealed if the subject were restudied. For example, it seemed possible from a study of the literature that a portion of the chemical changes and the spoilage noted in the early experiments might have been due to the milk enzymes, rather than exclusively to bacteria. This, however, did not prove to be the case; with the exception of some oxidized flavor, the changes in the milk were apparently due entirely to bacteria. The eventual bacteriological spoilage of the milk, marked by extensive proteolysis, was entirely in agreement with the observations of earlier workers.

The only point of importance which appears to be new, though not surprising, is that bacterial growth in pasteurized milk is much slower at 0° C. than in raw milk, so that pasteurized milk, if not recontaminated, keeps from two to three times as long as does raw milk of substantially the same quality or bacterial content. While a good quality of raw milk will usually keep for about four weeks before obvious spoilage occurs, a comparable pasteurized sample usually keeps in excess of eight weeks and sometimes as long as twelve weeks. That the improved keeping quality of pasteurized milk is apparently due to the entire destruction of certain kinds of bacteria is shown by the fact that the reinoculation of pasteurized milk with minute amounts of raw milk decreases its keeping quality to a point substantially the same as that of the raw milk.

The bacteria responsible for the spoilage of milk held just above the freezing point appeared to be mainly, if not entirely, gram-negative, non-spore-forming rods largely of the *Pseudomonas* group. Spore-forming bacteria played no part in the spoilage of the samples of milk studied and, so far as could be determined, made no growth at this temperature.

M4. Thermoduric Bacteria in Milk. III. The Effect of Changing Agar and Temperature of Incubation for Plate Counts on the Problem of Thermoduric Bacteria in Milk. J. L. Hileman, Clarence Moss and Betty Stead, Dairymen's League Co-operative Association, Inc., Syracuse, N. Y.

Bacteria counts were made on the old standard agar and on tryptone glucose extract milk agar at both 37° and 32° C. incubation temperatures on 100 lots of milk both before pasteurization and after pasteurization (a) in a commercial plant at 143° F. for 30 minutes, (b) in the laboratory at 143° F. for 35 minutes, and (c) in the laboratory at 161° F. for 16 seconds. The data show that changing the medium from the old standard agar to the new tryptone glucose extract milk agar, or changing the temperature of incubation from 37° C. to 32° C., or making both changes simultaneously, all have the result of increasing counts on both raw and pasteurized milk, when the average of a series of samples is examined. This is in agreement with results published in the literature. However, the percentage increase is far greater in the case of pasteurized milk, being from two to five times as great as with raw milk. This is because there is only a small percentage of thermoduric bacteria among the raw-milk organisms capable of growing on the old agar at 37° C., whereas there is a much greater percentage of thermoduric bacteria among those organisms requiring for their growth any one of the three changes in methods of making counts. This means that the thermoduric problem has been brought to light largely because of the change in the agar. It will be still further aggravated if and when the temperature of incubation is changed.

M5. Effect of Growth of *Pseudomonas putrefaciens* on Aroma Compounds in Butter. P. R. Elliker and B. E. Horrall, Purdue Agricultural Experiment Station.

Observations in the field and laboratory indicated that the development of putrid and cheesy odors and flavors in butter were accompanied, and in many cases preceded, by a loss of aroma in commercial butter. *Ps. putrefaciens* usually was found to be the causative organism. This suggested that *Ps. putrefaciens* might be active in destruction of the aroma compound, diacetyl, present in the butter.

Experimental lots of cream were sterilized in the autoclave, then cooled, and the cream churned in sterile churns. In certain lots the sterile butter granules obtained were then washed with sterile water and in other lots with water contaminated with a pure culture of *Ps. putrefaciens*. The respective types of butter were then worked, sufficient diacetyl added to provide a high aroma in the butter and after thoroughly distributing the diacetyl, the butter was placed in small sterile sample jars. In order to simulate the average treatment of commercial butter, the samples were stored at 70° F. for one week. They were examined at definite intervals for changes in odor, flavor and diacetyl content.

The results show that a definite decrease in diacetyl content accompanied the activity of *Ps. putrefaciens* in the butter during storage when diacetyl was added to the butter. When sterile water was used to wash the butter granules, the loss in diacetyl content in the butter during storage at 70° F. for seven days was very slight. However, when the wash water contained sufficient *Ps. putrefaciens* organisms to produce a cheesy or putrid flavor in the butter, the diacetyl content after four days of storage was reduced to less than one-half the original amount.

M6. The Effect of *Streptococcus agalactiae* Upon the Standard Plate Count of Milk. Max E. Morgan and E. O. Anderson, University of Connecticut.

Strains of *Str. agalactiae* were isolated from 20 different animals occurring in 14 different herds. Pure milk cultures of these 20 strains were plated in parallel on blood agar, Edwards' medium, the new and old standard medium. All 20 cultures grew well on 5 per cent blood agar and Edwards' medium. One culture failed to grow on the old standard medium and another showed no growth on the new standard medium. By using the variance ratio method of analysis, it was found that under the conditions of our experiments there was no significant difference between blood agar and Edwards' medium, and between the new standard and the old standard medium in their ability to support the growth of *Str. agalactiae*.

However, there was a very significant difference in the growth promoting properties of the blood media as compared to the media which did not

contain blood. It was found that the media containing blood supported more colonies than the media without blood in the ratio of $1.284 \overset{\times}{\div} 1.092 : 1$. Where growth occurred on both Edwards' and the new standard medium, it was found that Edwards' medium supported more *Str. agalactiae* colonies than did the new standard medium in the ratio of $1.375 \overset{\times}{\div} 1.078 : 1$.

The mean exposed areas of those colonies which grew on the media containing blood were larger than those growing on media which contained no blood in the ratio of $2.191 \overset{\times}{\div} 1.112 : 1$. A ratio of $4.203 \overset{\times}{\div} 1.184 : 1$ was found to exist between the mean area of the colonies on the new standard and the mean area of those on the old standard medium.

Data were secured on 94 herds infected with *Str. agalactiae* mastitis. With 33 of these herds in which the per cent of quarters infected was known, a very significant correlation was found to exist between the per cent of quarters infected and the number of *Str. agalactiae* present in the herd samples. Considering all samples, there was no correlation between the total counts on the new standard medium and number of *Str. agalactiae* occurring in the samples. The high contribution of *Str. agalactiae* to the total count was 48.0 per cent, without correcting for the difference in the growth supporting ability of Edwards' and the new standard medium. The logarithmic mean of the total counts on the new standard was 28 per cent higher than the mean of the counts on the old standard medium. In view of the results of the pure culture platings on these two media, it was felt that this difference could not be attributed to the presence of *Str. agalactiae*.

M7. The Lethal Effectivenes of Ultraviolet Rays Applied to Milk. G. C. SUPPLEE, G. E. FLANIGAN, AND O. G. JENSEN, Borden Biological and Chemical Research Laboratories, Bainbridge, N. Y.

The lethal effectiveness of ultraviolet radiation is well-known, but available evidence concerning the degree of destruction of bacteria in milk under conditions which are adaptable for practical use, is very meager. The results from studies with commercial milk extending over a period of some years, have revealed the merits and limitations of this bactericidal principle as applied to milk wherein certain improvements in the experimental technique were employed.

By irradiating smooth flowing milk films of known characteristics and using appropriate spectral quality and intensity of the incident radiation, a reduction in bacteria count of average raw milk of 95 to 98 per cent was obtained, with substantial regularity. This reduction may be accomplished without development of adverse flavor and odor within an exposure period of about seven to eight seconds or less. The spectral characteristics and the intensity of the radiations and method of application were found to be more

significant in obtaining a consistent high percentage reduction, than variations in the resistance of the organisms comprising the usual milk flora.

Sub-lethal applications of ultraviolet energy of which a predominant proportion consisted of short radiation (2200–2300 Å but with none of the 2537 Å line) gave irregular results with evidence that such radiation may actually increase the bacteria count of milk under given conditions. Whether the increase in plate counts was due to a dispersal of clumps or to a stimulating effect on individual organisms is a matter of conjecture.

Irradiation at elevated temperatures, or simultaneous irradiation during elevation of the temperature by electrical heating of the flowing film, did not significantly enhance the lethal effectiveness of the ultraviolet energy; such method of treatment tends to develop a characteristic irradiation flavor.

Percentage reduction curves obtained with an experimental flowing film electric pasteurizer wherein the temperature may be raised to any desired degree within a period of about 0.8 second are compared with percentage reduction curves obtained by ultraviolet radiation under varying conditions of treatment. The data illustrate comparatively, the bactericidal effectiveness of both forms of energy applied to milk under conditions potentially adaptable for other than laboratory demonstration, and wherein the time element is reduced substantially to an irreducible minimum.

M8. Bacteriological Problems in Short Time High Temperature Pasteurization. HAROLD WAINESS, York Ice Machinery Corpn., York, Penna.

Many dairy plants that have installed a high temperature short time pasteurization system have found that their previous system of laboratory control was inadequate. Neither a raw milk plate count, direct microscopic count, or the methylene blue reduction test, used alone could detect the presence of thermoduric micro-organisms in their present milk supply.

Experiments conducted with a large number of producers in Kentucky, Illinois and Wisconsin have shown that a combination of the resazurin test and plating the milk of individual producers, before and after pasteurization, gave the best results. Here we were able to single out those producers whose milk was high in thermoduric organisms. A visit to their farms always uncovered the source of these organisms in dirty milking machines and utensils.

For small plants that cannot afford expensive bacteriological equipment, the resazurin test used alone was found to be a relatively accurate index of thermoduric contamination.

M9. The Foaming of Milk and Certain Milk Products in Relation to Their Surface-active Constituents. M. S. EL-RAFEY AND G. A. RICHARDSON, University of California.

Foaming properties of the major surface-active constituents of milk in-

cluding casein, lactalbumin and lactoglobulin are reported. A modified procedure for isolating undenatured casein with a lipid content as low as .06 per cent is used: skim milk is super centrifuged; the casein precipitated at low temperature with 0.1 N HCl; the casein washed, frozen and partially air-dried by an electric fan during thawing.

The foam measuring apparatus used is based on the principle of forcing a known volume of air through a sintered glass disc and the layer of liquid above it, at a definite temperature. According to experimental data, the subsidence of skim milk foams cannot be defined by a single equation at temperatures between 5 and 55° C. A unit called "half-volume time" is recommended, therefore, for comparing the stabilities of foams.

The foaming properties of whey, skim milk, whole milk, and cream have been studied at temperatures between 5 and 55° C. Synthetic solutions containing lactalbumin, calcium caseinate, milk triglycerides and phospholipids have been found adequate to duplicate the foaming properties of these milk products.

The results obtained indicate preferential adsorption of calcium caseinate at the air/skim milk interface at temperatures below 27° C. and of lactalbumin at higher temperatures. Fat has proved to be responsible for the minimum foaming of skim milk at temperatures around 27° C.

A hypothesis supported by experimental work explains the formation of a phospholipid-protein complex that imparts the foaming properties to cream. The formation and stability of a "cream-type foam" has been shown to be a function of the per cent of phospholipid in the fat and the per cent fat in the skim milk or whey emulsions.

M10. Factors Affecting the Gas Content of Milk. C. I. Noll and G. C. Supplee, Borden Biological and Chemical Research Laboratories, Bainbridge, N. Y.

A quantitative study has been made of the dissolved gases in milk as affected by light, heat, vacuum, displacement by other gases and processing, in order to observe the general principles governing the gas content of milk. Particular attention has been given to the oxygen content of milk and the study of methods for its removal.

Data are submitted showing that, within the limitations of the experimental procedures used, the oxygen content of milk is primarily a function of the partial pressure of the oxygen over the solution and the temperature of the solution. This is in agreement with the accepted laws of solutions of gases in liquids.

Quantitative experimental data are given showing the gas content of milk at various stages in several pasteurization processes, the loss of gases during the heating and their subsequent reabsorption on exposure to air during cooling.

The degree to which the oxygen content of milk can be lowered by heat (below boiling temperature), vacuum, displacement with other gases, light and light in the presence of added ascorbic acid is presented. The application of these data to the development of methods for the deoxygenation of milk is discussed with appropriate experimental evidence.

The correlated data show that if the dissolved oxygen in milk is completely removed, the vitamin C of fluid or processed milk is stable, notwithstanding subsequent heat treatment or exposure to light. Such factors as heat, exposure to light, the presence of copper, etc., appear to be secondary catalytic influences affecting the rate of destruction of vitamin C only if dissolved oxygen is present.

M11. Factors Influencing the Response of Cream to a Rebodying Process. F. M. SKELTON AND H. H. SOMMER, University of Wisconsin.

It is generally recognized that considerable variation is encountered when subjecting pasteurized cream to a rebodying process such as that devised at the Geneva Experiment Station and known as the Geneva Heat Treatment Method. The wide variations in the response to this method have limited its commercial usefulness. A suitable explanation of the increase in viscosity is lacking, although several have been postulated, *i.e.*, fat globule clumping, increased protein hydration or both.

Recent work at Cornell permits the speculation that a substance "agglutinin" is associated with the fat globule membrane, reversibly adsorbed, and which possesses the property of promoting extensive fat globule clumping as determined indirectly by cream line studies.

It has been demonstrated here in corroboration of the work of Sharp *et al.*, that this substance is adsorbed on solid fat globules, but is released into the skimmilk when the fat is liquefied. With this in mind, experiments were conducted to study the effect of this substance on the viscosity of raw and pasteurized cream and their response to rebodying.

Mixed herd milk was divided into 2 lots. Lot I was separated at cow temperature immediately after milking, while Lot II was first cooled to 40° F. for 6 hours, rewarmed to 90° and then separated. Each lot of cream was standardized with its corresponding skimmilk to 30% fat.

The viscosity of the raw, pasteurized and heat-treated cream from each lot after 24 hours' aging was determined. It is evident from our studies, that cooling prior to separation produces the more viscous raw cream, but pasteurization eliminates this difference. Further, the cream from uncooled milk shows a greater response to rebodying. It would appear then that the previous temperature history of the milk is important in determining the response to rebodying.

Determinations were made of the viscosity of raw, pasteurized and heat-treated cream aged for 24 hours obtained at separating temperatures of 70°,

80°, 90°, 100°, 110°, 120° and 130° F., and also the surface tension values of raw skimmilk obtained at each temperature. Separating temperatures of 80° or 90° F. seem to be near the optimum insofar as response to rebodying is concerned. While the surface tension of the skimmilk was found to increase with the separating temperature, there is no evident relationship to the optimum for rebodying.

Studies were made of the viscosity of raw, pasteurized and heat treated cream prepared as follows: Cream A prepared from milk separated at 60° F. and standardized to 30% fat with skimmilk from milk separated at 130° F. Cream B was prepared from milk separated at 130° F. and standardized to 30% fat using skimmilk from milk separated at 60° F. Cream A was then rich in "agglutinin" while Cream B was supposedly poor in this material. The results substantiate the evidence presented above and lend support to the belief that the substance or substances influencing the response to heat treatment is not inactivated by pasteurizing temperatures, is intimately associated with the fat globule membrane, is reversibly adsorbed being released into the skimmilk when the fat is liquefied.

Preliminary investigations using reconstituted and washed creams indicate that lecithin may be an important constituent of the fat globule membrane materials with respect to its response to rebodying. The addition of lecithin to skimmilk reconstituted cream yields a product which behaves in a somewhat similar manner to normal cream. However, while it must be admitted that such a reconstructed cream is probably far from simulating a normal cream, the results obtained further substantiate and lend support to the belief that substances associated with the fat globule membrane, are important in determining the response to rebodying. Considerably more attention is likewise focused on the temperature history of the milk in view of the fact that changes in the physical state of the fat influence the kind and amount of adsorbed material.

M12. An Improved Micro-Kjeldahl Apparatus and Procedure for the Analysis of Milk. M. C. Rhees, T. R. Freeman, and Chas. N. Shepardson, A. & M. College of Texas.

This progress report concerns improved apparatus and methods developed in an investigation of composition of milk produced in Texas. It was found that certain Kjeldahl technique could be modified to gain considerable speed and accuracy in the analysis of milk.

The results indicate that the improved Micro-Kjeldahl method is readily adaptable for the determination of milk protein, because (1) a .2 gram sample of milk is used in each determination, (2) the use of buffered potassium perchlorate gives a catalyst which effects digestion in 10 minutes, (3) the distilling apparatus eliminates the need for transferring the digested sample, as is necessary with other Micro-Kjeldahl stills, (4) distillation can

be accomplished in three minutes, thus making a complete determination possible within 20 minutes. Duplicate samples checked within .4 per cent of the Official Gunning-Arnold method on milk and whey and recovered over 98 per cent of the nitrogen from urea and potassium ferrocyanide. Where large numbers of samples are to be run it is possible to average a complete determination every five minutes.

Preliminary studies conducted over a one year period showed the milk in Texas to be low in lactose as compared to the average figures reported elsewhere, while the ash is inclined to be higher.

M13. A Progress Report on the Utilization of Apple Products, Especially Apple Syrups and Juices, in Producing Soft-Curd Milk. C. C. Flora and C. W. Holdaway, Virginia Agricultural Experiment Station.

There are several methods of lowering the curd tension of market milk but none of these methods have made use of apple syrups or juices as a means of modifying market milk for infant food. The use of apple powder or vinegar (acetic acid) has been suggested for producing certain results in modifying milk for infant feeding, but no curd tension readings were made.

Concentrates of apple syrup, apple juice, apple syrup with increased pectin and apple juice with increased pectin showed considerable reduction in the curd tension of market milk. However, concentrates of apple juice and apple juice with increased pectin produced the greatest influence on curd tension.

Concentrate apple syrup in dilution of 100 ml. of syrup to 300 ml. of market milk lowered the curd tension below 8 grams. Concentrated apple juice in dilutions (1–10) lowered the curd tension to 10 grams or below and concentrated apple juice with increased pectin was almost as effective as the concentrated apple juice. The concentrated apple syrup with increased pectin showed a greater reduction than the concentrated apple syrup, but not as great as with the concentrated apple juice.

The addition of pectin seems to be very effective in lowering the curd tension but the pH seems to be the most important factor.

M14. The Determination of Citric Acid in Milk by the Pentabromoacetone Method. E. F. Deysher and George E. Holm, Bureau of Dairy Industry, U. S. Department of Agriculture.

A study of the various procedures of the pentabromoacetone method has been made and the conditions determined which will result in the greatest percentage recovery of citric acid, in pure solution and in milk. The modifications of Lampitt and Rooke have been followed in general, except as follows: (a) After addition of excess permanganate the mixture was allowed

to stand at ice-box temperatures for 16 to 18 hours before discharge of excess permanganate with ferrous sulfate, (b) the precipitate was washed with 50 cc. of water of a temperature of 3° C., and (c) the drying was in a vacuum desiccator at temperatures not over 20° C. With the modified procedure the citric acid in pure solutions was determined with an error of approximately ± 0.50 per cent and in milks with an error of approximately ± 1.00 per cent, of the theoretical values.

M15. The Effect of Flash Forewarming upon the Heat Stability of Evaporated Milk. B. H. Webb and R. W. Bell, Bureau of Dairy Industry, U. S. Department of Agriculture.

Milk was "flash" forewarmed in a specially constructed tubular heater by heating it in 3 seconds to temperatures up to 163° C. (325.4° F.), maintaining the temperature for 15 seconds and cooling in 2 seconds. Fresh milk generally coagulated during passage through the heater when the temperature was between 160° C. and 163° C. The effect of flash forewarming of milks at different temperatures up to 160° C. upon the heat stability of their evaporated products was determined by sterilizing the concentrated milks in cans at 115° C. until coagulation occurred. The results were compared with the heat stability values obtained by forewarming portions of each milk to 95° C. in accordance with the accepted procedure used in the evaporated milk industry.

Flash forewarming of skim milk at temperatures between 100° C. and 120° C. caused a large increase in the heat stability of its evaporated product as the forewarming temperature was raised. An increase in forewarming temperatures between 120° C. and 155° C. improved stability further. Flash forewarming whole milk up to 120° C. did not improve the heat stability of its evaporated, homogenized product over the 95° C. control. However, increases in the flash forewarming temperature of whole milk from 120° C. to 155° C. caused an abrupt increase in heat stability. The heat stabilities of evaporated skim and whole milks flash forewarmed to their optimum temperatures were increased from 2 to 6 times the stabilities of the control samples forewarmed to 95° C. Among the practical applications of these observations are the possibilities of decreasing the use of stabilizing salts in the manufacture of evaporated milk and of increasing the amount of milk solids which may be included in a can of evaporated milk.

M16. The Influence of Homogenizing Pressures on the "Dryness" of Ice Cream when Drawn from the Freezer. J. H. Erb and John Whitworth, Ohio State University.

Several series of regular ice cream mixes having the composition of 12 per cent fat, 11 per cent serum solids, 15 per cent sugar, and .25 per cent

gelatin, were processed under varying conditions of homogenization using a Manton-Gaulin two-stage homogenizer. Homogenization was carried out at the pasteurizing temperature of 155° F.

In one series of mixes the pressures were varied from 1,000 pounds to 5,000 pounds single stage. In another series the pressures were the same except that 500 pounds pressure was applied to the second stage. Other trials were run in which the mix was sent through the homogenizer twice at various pressures. The mixes were frozen using a Creamery Package 60 gallon per hour continuous freezer and a York batch freezer. At every trial all mixes were drawn from the freezer at the same temperature, and the apparent wetness or dryness was determined by observing the condition of the ice cream as it emerged from the freezer and also by noting how the ice cream resisted melting when exposed to room temperature for approximately five minutes. The results indicate the following:

(1) The higher the pressure applied to the mix and the oftener it was homogenized, the wetter the ice cream appeared when it was discharged from a continuous freezer at a given temperature. The same difference was noted in the batch freezer, but the differences were not as marked.

(2) The pressure of homogenization was found to have considerable effect on the melting characteristics of ice cream. With mixes of normal acidity and salt balance, the higher the pressure the smoother was the melt down.

(3) Ice cream subjected to high pressures of homogenization or processed at high pressures several times melted at a more rapid rate than mixes processed at lower pressures.

(4) There was found to be a slight improvement in the body of the ice cream processed at the higher pressures.

M17. Monoglyceride-Gelatin as an Ice Cream Stabilizer. P. S. Lucas, Michigan State College.

Among the promising products perfected during recent years for hastening the incorporation and ease of incorporation of air in ice cream mix during freezing is a homogeneous mixture of a monoglyceride and gelatin. The use of monoglyceride in ice cream is patented. Conceivably, the addition of gelatin and a suitable monoglyceride as separate ingredients to the mix might produce results similar to those produced by a prepared mixture.

In this study both were used: the former at the rate of 0.4 of 1 per cent; and the latter at the rate of 0.3 per cent of gelatin of 275 Bloom grade, with .06 per cent of monoglyceride. Both were checked against gelatin alone, the equivalent amounts of each being calculated from their Bloom test. While emphasis was placed upon the body score of the ice creams, these organoleptic methods were supplemented by microscopic examinations

together with measurements of the ice crystals. Examinations were made at day, week, and two-week intervals.

The gelatin-glyceride mixture reduced freezing time 16 per cent on the average. The score of the product when fresh was increased on the average by about one-third of a point. After one week's storage, the score was reduced to a quarter of a point, remaining at this figure for the two-weeks' storage period. Flavor was affected in no case.

The product made with gelatin and with the gelatin monoglyceride prepared mixture varied more however, than indicated by score alone, the body of the ice cream made with the latter being much more compact and giving the appearance of being heavier and in some cases somewhat richer. These values were paralleled when monoglyceride was added to gelatin at the time of pasteurization in the proportions mentioned. Considerable difficulty was encountered, however, in this case due to the oxidation of the particular glyceride used. This oxidized flavor was carried into the ice cream to such a degree that the product was practically unsalable. This product should not be confused with the prepared mixture of gelatin and monoglyceride.

Microscopic studies showed smaller ice crystals when gelatin and monoglyceride mixture was used. Both products acted in a manner very similar to egg yolk in increasing whippability of the mix.

M18. A Method for the Preparation of Acid Casein for Use in Ice Cream.
L. P. Teichert, T. R. Freeman, W. S. Arbuckle, and Chas. N. Shepardson, A. & M. College of Texas.

This investigation presents a simple and inexpensive method of concentrating skimmilk for satisfactory use as a source of serum solids in ice cream.

Dilute hydrochloric acid was added to skimmilk to form an acid curd. The curd thus formed when washed and drained contained from 29 to 32 per cent solids and could be stored in a frozen condition satisfactorily.

A rapid method of dissolving curd for use in ice cream mix is suggested. This was accomplished by the addition of a basic salt, after which the curd was added to the other ingredients of the mix at a temperature of 120 to 130 degrees Fahrenheit.

The dissolved curd gave most satisfactory results when the pH was adjusted at 6.5 to 7.2.

The adaptability of several neutralizers and the amounts of each necessary to bring the dissolved curd within the desired pH range were studied. Sodium carbonate and sodium bicarbonate proved to be most satisfactory.

A preliminary study indicates that acid casein may be used to supply up to 40 per cent of the serum solids content of an average commercial mix. In most cases the mixes showed excessively rapid whipping ability and a high maximum overrun. In the finished ice cream a slight curd flavor was observed in some cases, and the body was criticized as being gummy.

Results show, however, that the rate of whipping and maximum overrun can be controlled by slightly decreasing the serum solids and gelatin content, or by the addition of small amounts of calicum chloride. The gummy defect was also largely eliminated by reducing the gelatin and serum solids content.

Sandiness was not encountered in any of the ice creams studied even after prolonged holding at fluctuating temperatures.

The data indicate that acid casein prepared from skimmilk may be of considerable value as an economical source of serum solids in ice cream and offers a valuable method of utilizing surplus skimmilk.

M19. The Temperature Method for Control of Whipping in Ice Cream. ALAN LEIGHTON, Bureau of Dairy Industry, U. S. Department of Agriculture.

Experiments show that a maximum whip consistent with the existing temperature is attained in the batch ice cream freezer shortly after the refrigerant is turned off. It follows that, with the position of the temperature-overrun equilibrium line known for the given mix, the thermometer may be used to indicate the proper point for turning off the refrigerant and the proper time for drawing the mix. Such a method is practical only if similar mixes exhibit uniform whipping properties from day to day. The experiments show this to be the case.

The deposition of butterfat upon the blades of the freezer lowers by 5 to 10 per cent the overrun obtainable at a given temperature. Since butterfat usually accumulates slowly upon the blades of a freezer, four or five batches must be frozen before completely uniform results may be expected for the succeeding runs. A drawing temperature of from 0.1° C. to 0.2° C. higher is necessary to overcome overrun loss due to the accumulation of butterfat.

Uniform results have been obtained by applying the method to indentical mixes whipped in a horizontal 20-quart brine-cooled freezer, a 20-quart horizontal full-flood ammonia refrigerated freezer and in a 10-quart vertical freon direct-expansion counter freezer. The time intervals necessary for freezing varied markedly with the different freezers.

By following the procedure outlined in the paper the manufacturer can be sure that he is drawing his mixes at the lowest possible temperature consistent with the desired overrun, also that his freezings are being carried out in the shortest possible time.

M20. Motion Pictures as a Medium for the Study of Ice Cream.* W. H. E. REID, C. W. DECKER, L. E. SMITH, K. R. MINERT, W. S. ARBUCKLE, AND JOE EDMONDSON, Missouri Agr. Expt. Station.

Studies have been made using motion picture photography as a means of

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showing in detail the effect of several factors upon the physical appearance, resistance to medium high temperatures, and stabilizing properties of ice cream of variable composition and manufacturing methods. This investigation includes the use of variable increments of sucrose and dextrose sugars as influenced by a variation in the freezing procedure and acid standardization of mixes to which are subsequently added bacterial cultures in different volumes.

M21. Homogenization Index as Calculated from Measurements of Fat Globule Size. ARTHUR W. FARRALL, CHARLES C. WALTS, AND RODNEY L. HANSON, Creamery Package Manufacturing Co.

The comparison and evaluation of the results of homogenization have been expressed as a simple number called homogenization index. This index makes possible the determination quite accurately of even small differences in homogenization.

A microscope is fitted with an eyepiece containing a measuring scale 100 microns square, which is divided into sixteen equal squares, and containing a scale across the center which is divided into 2 micron divisions. The size class, and number of the fat globules exceeding 2 microns in diameter are determined in five random fields, using the oil immersion lens. A chart was constructed to simplify the recording of the data and calculations. The homogenization index is equal to the number of fat globules of two microns in diameter which would have the same volume as the fat globules which exceeded two microns in diameter.

M22. The Effects of the Direct Addition of Carotene and Mixed Tocopherols on the Development of Oxidized Flavor in Milk. EDWIN B. WILLIAMS AND L. H. BURGWALD, Ohio State University.

Cows in the University herd were selected which produced milk that would develop an oxidized flavor "spontaneously." Part of the milk was pasteurized in glass at 143° F. for 30 minutes and carotene was added directly to the milk both before and after pasteurization at the rate of 500, 1000, and 1500 units of vitamin A per quart. The remainder of the milk was kept raw and carotene was also added to these samples at the same rate as for the pasteurized samples. The source of carotene used was a compound known as Provalac, manufactured by General Biochemicals Company. In no case did the carotene show an inhibitory effect upon the development of the oxidized flavor.

Experiments were conducted to determine the effect of mixed tocopherols upon the development of oxidized flavor in "spontaneous" milk. The milk was pasteurized in glass at 143° F. for 30 minutes. An oil assaying 41.1 per cent of natural mixed tocopherols prepared by Distillation Products, Inc., was added to the milk after pasteurization by emulsifying it into a small quantity of homogenized milk and adding the mixture to the "spon-

taneous'' milk. A concentration of the tocopherol oil of 0.5 per cent of the fat content of the milk was effective in prohibiting the development of the flavor defect for at least 96 hours and in the majority of cases for 144 hours.

A few experiments have been conducted to determine the effect of the tocopherol concentrate upon the development of metal-induced oxidized flavor. Copper was added after pasteurization in the amount of 2 p.p.m. to milk pasteurized in glass at 143 F. for 30 minutes. The tocopherol oil in the concentration of 0.5 per cent of the fat content of the milk inhibited the development of the oxidized flavor up to 72 hours and markedly reduced the intensity of the defect at 96 hours. In one experiment, the tocopherol concentrate completely prevented the development of the oxidized flavor for 144 hours in raw milk contaminated with 2 p.p.m. copper and the pasteurized samples containing the oil had only a trace of oxidized flavor at 120 hours while the control samples had an intensity of 4 plus.

Since the tocopherol concentrate was found to inhibit the development of oxidized flavor, a study was made to determine what effect it had upon the vitamin C content of the milk. The vitamin C content was determined according to the titration method outlined by Sharp. It was found that the addition of the tocopherol oil in the concentration of 0.5 per cent of the fat content of the milk hastened the destruction of the vitamin C in the milk to a marked degree. On the other hand, the addition of carotene at the rate of 1500 units of vitamin A per quart seems to have a very slight protective action towards the vitamin C, although the results are not conclusive.

M23. The Influence of Treated Fibre Milk Containers on the Incidence of Copper-Induced and Sunshine Oxidized Flavors of Milk.

C. L. ROADHOUSE AND J. L. HENDERSON, University of California.

Manufacturers of fibre milk containers are interested in securing paper stock that will exclude sunlight from milk, and if possible, prevent or delay the development of copper-induced oxidized flavor of milk. Fibre cartons, and strips cut from cartons, were especially treated for use in these experiments.[1]

The containers were treated by two methods: 1. Avenex was added to the paper stock before paraffining to attempt to delay the development of oxidized flavor of milk to be placed in them, and 2. Paper stock was impregnated with titanium dioxide in order to increase its opacity and exclude light rays that might influence the flavor of the milk. The paper strips were prepared by treating the paper stock before paraffining with Avenex, with the n-butyl ester of tyrosine or with cocoa shell flour.

Three types of milk were tested: Holstein, Jersey, and a mixture of the

[1] Fibre containers and strips were prepared by the American Can Company in their plants and laboratories.

two breeds. The milks were pasteurized in stainless steel equipment. In certain experiments 0.25 p.p.m. cupric ion (as copper sulphate) was added when the pasteurizing temperature (143° F.) was reached. After pasteurization fibre containers were filled and the milk flavored daily for three days as unknowns. The fibre strips were tested by being submereged in milk held in half-pint bottles. These samples likewise were scored for flavor daily for three days.

When the influence of sunlight was being studied, the containers were exposed for 30 minutes to the direct rays of the sun during the middle of the day. The milks were tested for ascorbic acid daily for three days after treatment.

Results: 1. Samples that were uncontaminated with copper.

The rate of ascorbic acid destruction in milk exposed to sunlight for 30 minutes in treated and untreated containers indicate no significant differences in the amount of sunlight excluded. In all samples the rate of disappearance of ascorbic acid was slightly greater than in duplicates kept in the dark. In general the milk flavor was only slightly impaired by the 30 minute exposure period.

2. Samples that were contaminated with copper.

None of the treated containers or strips prevented the development of oxidized flavor. The oxidized flavor was more pronounced when the samples were exposed to sunlight for 30 minutes.

M24. An Electric Laboratory Pasteurizer. H. B. Henderson, Thos. B. Harrison, C. E. Wylie, and H. A. Arnold, University of Tennessee.

A pasteurizer was built on the style of the commercial spray type vats. It has six separate compartments or vats making it possible to pasteurize as many as six, two-quart samples of milk at the same time under exactly the same conditions. The milk is heated by a film of hot water flowing down the sides of the vats. This water is electrically heated in a compartment at the bottom of the pasteurizer, and is circulated by a centrifugal pump through specially perforated pipes so arranged as to direct a spray of water against the sides of the vats. The water runs back to the bottom of the pasteurizer where it is reheated and again circulated through the system. The temperature of both the water and the milk is thermostatically controlled. The pasteurizer is of stainless steel construction throughout.

M25. Observations Regarding the Occurrence of Oxidized Flavor in Milk from Individual Cows. H. B. Henderson, W. W. Overcast, and C. E. Wylie, University of Tennessee.

During the past two years considerable data have been collected at the Tennessee Station regarding the development of oxidized flavor in milk from

individual cows as related to feeds, lactation, season, age, level of feeding, and production.

From the data collected it would appear that a high level of feeding may tend to increase the susceptibility of the milk to develop oxidized flavor. This was observed during the summer months, when the cows were on pasture, as well as during the winter months. These data would indicate that lactation, season, age, and feeds may have variable effects on the development of oxidized flavor in milk. Since the milk production follows the general trend of the feeding level it would appear that cows during high production periods may produce milk more susceptible to the development of oxidized flavor, than during periods of lower production.

M26. A Small Electric Holder Type Pasteurizer.* C. W. ENGLAND, ARTHUR P. WIEDEMER, AND GEORGE J. BURKHARDT, Maryland Agricultural Experiment Station.

The enactment of ordinances prohibiting the sale of raw milk to the consuming public has created a demand in rural communities for a small pasteurizer. This pasteurizer studied consists of a rectangular synthetic rubber-lined steel vat of 12 gallons capacity with an agitator of non-conducting material and electrically heated with a carbon electrode in each end. The resistance of milk to the flow of an alternating current between the electrodes provides heat for pasteurization.

To compare the efficiency and adaptability of the electric pasteurizer, various lots of milk were pasteurized in a 200-gallon, spray-type holder pasteurizer and in the electric pasteurizer, and results of tests on each compared. Tests made on each lot of milk included: flavor score, creaming ability, total bacteria count, coliform count, per cent butterfat, per cent titratable acidity, pH and curd tension. The results of these tests indicate that the process used in the electric pasteurizer is essentially a heating process and that when like temperatures and holding periods are used, the results of the electric and spray-type holder methods compare favorably.

Tests have also been made to determine the practicability of pasteurizing uncooled milk. The results of these tests show that pasteurization of uncooled milk immediately after milking compares favorably with milk cooled prior to pasteurization.

The time required for heating small batches is somewhat greater and the efficiency is somewhat lower than for large batches. Approximately 0.24 kwhr. is required during the holding period regardless of the size of the batch. Using current at 2 cents per kwhr., the total current cost of pasteurizing a 12-gallon batch would range from 3.96 cents with a starting temperature of 90° F. to 7.32 cents with a starting temperature of 38° F.

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M27. Some Factors Influencing the Quality of Cream Cheese. B. M. ZAKARIASEN AND W. B. COMBS, University of Minnesota.

The following standard manufacturing procedure served as a foundation from which other manufacturing procedures were developed in an attempt to improve the firmness, texture, shrinkage, keeping quality and flavor of cream cheese:

Cream was standardized at 16 per cent butterfat, heated to 150 degrees F., run through a single stage homogenizer at 1500 pounds pressure and then cooled to 70 degrees F. Forty-hundredths per cent of active starter was added and the cream held at 70 degrees F. until a titratable acidity of .70 to .75 per cent was developed. The clotted cream was agitated while being heated to 120 degrees F., held for 30 minutes and then an equal quantity of cold water was added after which it was cooled to 65 degrees F. The clotted cream was then poured into muslin bags and pressed to one-half the weight of the original cream while being held at room temperature. The drained curd was then placed in a steam jacketed kettle and both salt and gelatin added at the rate of .75 per cent. It was then heated to 150 degrees F., homogenized at 3000 pounds pressure and allowed to flow into the containers.

Some of the factors that were studied are as follows:

A. Variations in treatment of the cream.
   1. Varied the heating temperatures from 150 to 175 degrees F., homogenization temperatures from 150 to 175 degrees F. and pressures from 1500 to 3000 pounds.
   2. Varied the titratable acidity in the ripened cream .65, .85, .90 and 1.0 per cent.
   3. Varied the temperature at which the ripened cream was cooked 120, 140 and 160 degrees F.
   4. Added water before cooking ripened cream.
   5. Eliminated the practice of adding water to the ripened cream.
   6. Eliminated the practice of homogenizing the cream after pasteurization and before the addition of the starter.

B. Variations in the treatment of the cheese.
   1. Varied the temperatures from 150 to 175 degrees F., homogenization temperatures from 130 to 175 degrees F. and pressures from 1500 to 4000 pounds.

The greatest improvement in the quality of the cream cheese was shown when the cream and the cheese were homogenized at relatively high temperatures and pressures, namely, 175 degrees F. and 4000 pounds pressure.

Homogenization of the cream for cream cheese reduced fat losses and prevented the oiling off of the butterfat during the heating of the cream cheese previous to homogenization.

A fine mild flavor was secured in the cream cheese when the cream was ripened to about .70 to .80 per cent titratable acidity.

No practical improvement was noted in the quality of the cream cheese when the ripened cream was heated above 120 degrees F., when the water was added to the ripened cream before heating instead of after or when the addition of the water to the ripened cream was entirely eliminated.

M28. A Short Method of Making a Soft Cheese Similar to Cream Cheese. E. L. Reichart and L. K. Crowe, University of Nebraska.

Cream cheese as made commercially today, usually contains from 30 per cent to 40 per cent fat and from 40 per cent to 50 per cent total solids. It is made by coagulating milk and cream mixtures, through the development of acidity, by means of starters, with or without the addition of rennet, heating and draining the curd, pressing to expel additional moisture, and packing, hot or cold, in a final container. This process usually requires from 48 to 72 hours, considerable equipment and space, and produces a finished product which in many cases is quite perishable.

A soft cheese of similar composition, of equally good flavor and texture characteristics and of superior keeping quality can be made by the following short-time method. Cream, cottage cheese curd, and salt, are used in such proportions as to give the desired fat and total solids content. This mixture is heated to 180° F., homogenized, and packaged directly from the homogenizer in the desired final package, and allowed to cool at a temperature of 35° to 40° F.

In these experiments, 150 batches of cheese were made from mixtures consisting of sweet and sour cream, cottage cheese curd, condensed skimmilk, and superheated condensed skimmilk, in such combinations as to vary the composition and to note the effect of these variations on the flavor and body of the finished product. Titratable acidities, pH values, and temperatures and pressures of homogenization were also varied to note the effect of these variations on the finished product.

It was found that mixtures of ripened cream (65 per cent fat, and .4 per cent–.45 per cent titratable acidity), cottage cheese curd, and salt, standardized so that the finished cheese would contain 30 per cent–32 per cent fat and 43 per cent–46 per cent total solids, and a pH of 4.5–4.7, heated to 180° F. and homogenized at 2500 lb. pressure, gave a finished product that had the most desirable flavor, body and texture characteristics, as well as the best keeping quality and compared favorably with similar products found on the market at the present time.

M29. A Survey of Commercial Cottage Cheese. Milton J. Foter, E. O. Anderson, and L. R. Dowd, University of Connecticut.

A survey was made of open-market and plant samples of cottage cheese. The microbiological analysis consisted of determining the relative numbers of bacteria, molds and yeasts per gram of cheese and the presence of members of the coliform group. The cheese was analyzed for flavor, texture, fat, salt and moisture.

The microbiological analysis showed the numbers of bacteria to vary widely. The most common spoilage organisms found were yeasts varying in numbers from 0 to 24,000,000 per gram of cheese. The flavor analysis showed that 31 per cent of the total number of samples were yeasty, 22 per cent sour and 20 per cent bitter. Only about 10 per cent of the samples were not criticized for flavor. The fat, salt and moisture content of the cottage cheese examined varied from 0.88 per cent to 10.8 per cent; from 0.06 per cent to 1.0 per cent and from 67 per cent to 84.5 per cent, respectively.

The survey indicates a need for a more complete study of the yeast and mold flora, with respect to the establishment of standards for cottage cheese.

M30. The Relationship of Acidity to the Quality of American Cheddar Cheese. H. L. Wilson, S. A. Hall, and H. R. Lochry, Bureau of Dairy Industry, U. S. Department of Agriculture.

Laboratory investigations show that in making Cheddar cheese from raw milk of inferior quality a relatively high acid development is advisable, but if the milk is of good quality or is pasteurized the acidity at milling should not exceed pH 5.40 and the rate of development should be slow. In applying this to factory practice 183 vats of cheese were made in 2 average small factories. The milk was graded on the methylene blue test, pasteurized, the acidity at milling held to pH 5.40–5.55 with a making time of 4½ hours. Duplicate samples were stored 6 months at 34° and 50 or 60° F. and graded.

Of the cheese made in factory number 1, 53.9 per cent of the cheese stored at 34° F. and 7.8 per cent of the cheese stored at 60° F. scored 92 or better. In factory number 2, all cheese stored at 34 and at 50° F. scored 92 or better.

The cheeses from factory No. 2 were remarkably uniform, and samples at 50° F. were scored, on account of more flavor, an average of ½ point higher than those at 34°.

These experiments show that milk of good quality, pasteurized and made with proper control of acid development, will cure satisfactorily and develop a fine flavor at 50° F.

M31. Keeping Quality of Butter Stored at Low Temperature for Six Years. B. J. Scheib, E. S. Guthrie, and C. N. Stark, Cornell University.

Previously we have reported on the effect of certain factors upon the keeping quality of butter, when the butter was held at a temperature which would permit the growth of bacteria present. We have also reported on the growth of certain fat-splitting and casein-digesting bacteria present in butter in sufficiently large numbers to be responsible for the observed deterioration of the butter. Attention has been called to the possible significance of the presence of even small numbers of certain protein-digesting bacteria,

because of their ability to grow in butter, and the value of milk agar for detecting these bacteria in fresh butter has been stressed. Knowledge of the physiology of these proteolytic bacteria and also practical experience in buttermaking indicate that recontamination of pasteurized cream is usually the source of these bacteria.

Samples of these same batches of butters (96 in number) have been held at −10° F. for six years. Since bacteria are unable to grow at this temperature, it has been possible to observe the effect of (1) temperatures of pasteurization of cream, (2) salt, (3) acidity, and (4) salt and acidity upon the keeping quality of butter. The results of this study show the individual and combined effect of these factors on butter quality. Pasteurization at 165° F. for 30 minutes destroyed the harmful natural enzymes in cream; 145° F. for 30 minutes did not. The presence of salt definitely lowered the quality of the butter; butter made from acid cream was of poorer quality than sweet cream salted butter; the presence of both salt and acid produced butter of still lower quality. The average scores for butter, made from cream pasteurized at 165° F. for 30 minutes, and held at −10° F. for six years were: sweet cream butter 92.3; sweet cream butter salted 90.8; sour cream butter 87.5; sour cream butter salted 85.4.

M32. Mold Mycelia in Cream.* E. R. Garrison and J. H. Gholson.

This investigation was made to study the influence of farm methods on the amount of mold mycelia in cream. Beginning in October, 1940, samples of cream were obtained once every three weeks at each of the four cream stations in Columbia. The name of the producer, weight of cream, per cent butterfat, flavor, cream grade, temperature of the cream and days since the last delivery were obtained from the cream station operator. Samples of cream were obtained altogether from 310 producers. Questionnaires on farm methods of handling cream were filled out by personal interviews with 80 producers. The sources of mold on the farm were studied by examining the utensils by the agar disc and cotton swab methods and by plating feeds and other materials on acidified potato dextrose agar.

The cream samples were placed in ice water when collected and later taken to the laboratory where the following determinations were made: titratable acidity, formol titration, modified Wildman MBB (methylene blue-borax) test and the plate count for mold on acidified potato dextrose agar. A microscopic examination was made of each sample that had a low mold count and a doubtful or excessive MBB rating.

The grade of 655 cream samples as given by the cream station buyer and the MBB ratings were proportioned as follows: *Grade No. 1*, Good 44.0 per cent, Fair 21.0 per cent, Doubtful 7.0 per cent, Excessive 4.0 per cent. *Grade No. 2*, Good 2.3 per cent, Fair 3.5 per cent, Doubtful 2.2 per cent,

* Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series No. 741.

Excessive 1.1 per cent. *Grade No. 2 (test)* consisting of cream with a butterfat test of less than 25 per cent and not Grade No. 2 because of other defects had MBB ratings of Good 6.6 per cent, Fair 6.3 per cent, Doubtful 1.5 per cent, Excessive 1.1 per cent.

The index of correlation between the titratable acidities and MBB ratings was found to be +.822 with the standard error of estimate being .124 per cent. This correlation is very significant and indicates that in cream with high acid it is very probable that considerable mold is present.

The index of correlation between the MBB ratings and the logarithms of the mold plate count was found to be +.6813 with the standard error of estimate being 1.1640. While this correlation is significant it indicates that there are probably other factors besides the amount of mold mycelia in the cream that affects the MBB rating. The microscopic examination of those samples with a doubtful or excessive MBB rating and a low mold count showed the presence of many body cells which may have been due to either infected udders or cows in late lactation.

M33. Effect of Udder Infection and Late Lactation on the Methylene Blue-Borax Test for Mold Mycelia in Cream.* E. R. GARRISON AND J. H. GHOLSON.

It is generally assumed that the amount of sediment obtained by the MBB (methylene blue-borax) test is proportional to the amount of mold mycelia in the cream. However, occasional samples of cream that give a fair, doubtful or excessive sediment test according to the American Butter Institute mold standard contain very few mold by the plate count on acidified potato dextrose agar. A microscopic examination of the sediment obtained from the MBB test on these cream samples usually shows the presence of many body cells but few or no mold mycelia. This indicated that udder infection or late lactation might be factors that affect the MBB test on producers' cream.

In order to obtain information on this problem the milk from 72 individual cows in the University Herd was studied. The pH, per cent chlorides, and number of body cells in the fresh milk was determined. The milk was then held at 35°–40° F. for 24 hours then the cream was siphoned off and the MBB test performed on the cream and the skimmilk. The sediment test on the cream from 34 cows was rated as good, 20 as fair, 11 as doubtful, and 7 as excessive. The skimmilk gave very little or no sediment by this test even when the sediment test on the cream from the same sample was doubtful or excessive. The cream-mold reagent mixture from many samples was thick and slimy and difficult to filter. A microscopic examination of the sediment usually showed the presence of many body cells but no mold mycelia. There was a general, but not a close correlation, between the num-

*Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series No. 741.

ber of body cells in the milk and the amount of sediment from the MBB test on the cream. Centrifugally separated cream always gave a good MBB test even when the test on the gravity cream from the same milk sample was doubtful or excessive. This was probably due to the removal of many of the body cells and much of the mucous protein during centrifugal separation of the milk.

When the MBB test was applied to the gravity separated cream from the milk from individual quarters of the udder the amount of sediment varied with the different quarters and was correlated with the severity of infection. Many of the cream samples that gave a positive MBB test were from cows in advanced lactation with no udder infection. There was no variation in the MBB test with the individual quarters of these cows and the test became negative after the cows again freshened.

M34. The Effect of Various Factors on Mold Mycelia in Cream and Butter.* W. H. E. Reid, Joe Edmondson, and W. S. Arbuckle.

This investigation is concerned with various factors affecting mold mycelia development in cream and butter. Among these factors are the effect of time, variable temperature, stirred and non-stirred samples, variable butterfat percentages, layered and non-layered samples, and covered and non-covered samples.

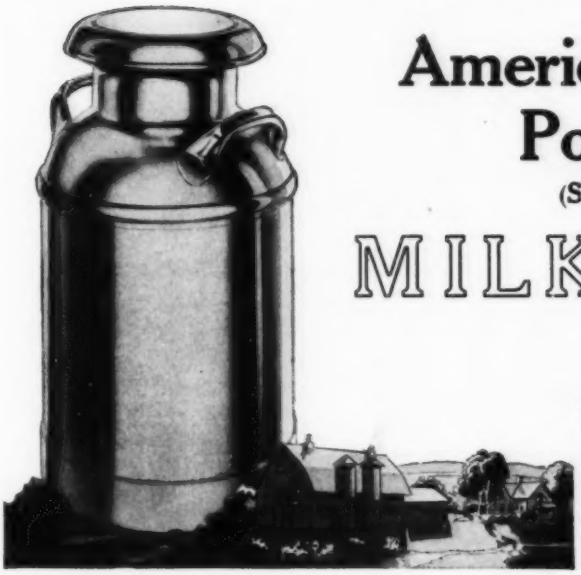
Mold mycelia tests were made of the cream by the application of the methylene blue borax (MBB) test which is a modification of the Wildman method. The MBB and the microscopic count were used in the butter analysis. The cream and butter samples were also analyzed for acidity, pH and organoleptic factors.

The data show that temperature is an important factor in the growth of mold mycelia in cream; it multiplies rapidly at the higher temperatures. This particular mold tolerates high acid. There is also a direct correlation of the time factor with the development of mold mycelia. The development of acidity, as the storage time was prolonged, may also have favored mold growth.

In a comparison of the stirred and non-stirred samples of cream the mold growth was more apparent in the stirred samples. This may be explained by the fact that this mold required air for development and grows only on the surface. In the resultant butter the non-stirred samples had a higher count because in the stirred samples the mycelia were broken up to such an extent that they could not be counted as positive fields.

Studies on covered and non-covered, layered and non-layered and variable butterfat series are in progress and the data are not sufficiently complete for conclusion.

* Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series No. 735.



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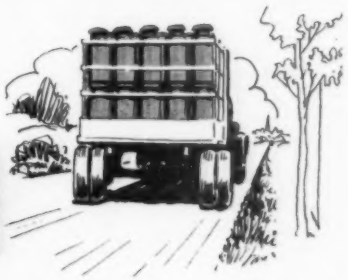

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Self-Defrosting - Non-Mechanical

ICE CREAM DIPPER

● Roldip* is a new word in the lexicon of ice cream retailing. It means the profitable, easy and popular Zeroll way to dip ice cream. Every day thousands of retailers Roldip* more profit into the cash register than ever before in spite of rising, uncontrollable operating costs, because the Zeroll dipper speeds the task of dipping, makes it easy, effortless, automatically measures the portion and avoids "shrinkage" and compression losses.

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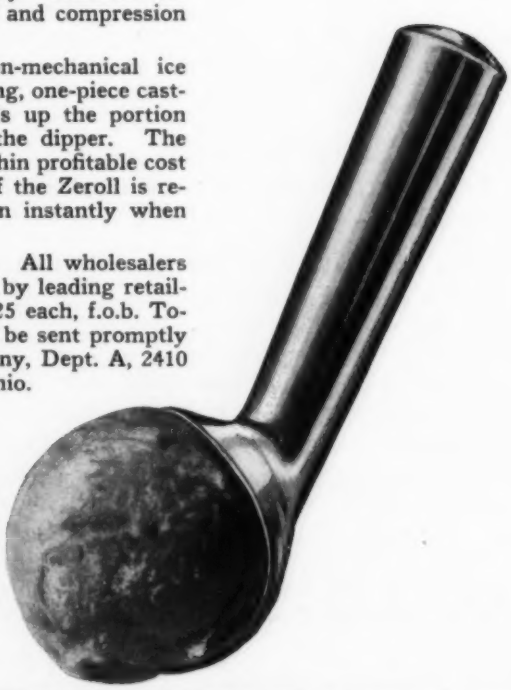
Available in all standard sizes. All wholesalers have stocks. Universally used by leading retailers everywhere. Priced at $2.25 each, f.o.b. Toledo. More complete data will be sent promptly on request. The Zeroll Company, Dept. A, 2410 Robinwood Avenue, Toledo, Ohio.



● The Zeroll dipper serves the ice cream just as it was made without changing structure of the product or contaminating its purity.

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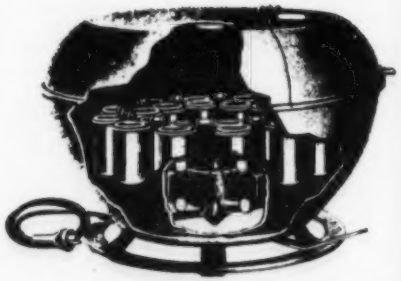
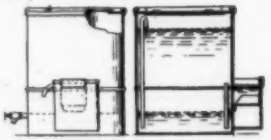
WARCO Underswing
ELECTRIC BABCOCK TESTER



The WARCO Underswing is fool proof. Water or over-flow can not reach motor or bearings. Heavy cast aluminum bowl, no brushes, smooth and quiet, slow starting. Heater if desired. Holds six inch glassware. Shipt complete with hand stopping brake. All standard sizes.

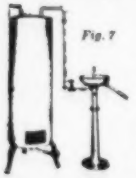
8-BOTTLE SIZE $33.00

WARCO BOILER



The patented WARCO Boiler is fool proof and perfectly safe as all surplus steam pressure from the lower section of Boiler passes into the upper section or cold water compartment. Has indirect heated test bath and sample warmer. Boiler may be purchased separately.

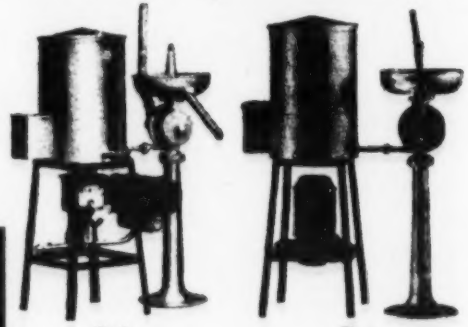
WARCO CITY PRESSURE WASHER



Burns gas. Boiler will meet all legal requirements and is tested at 200 lbs. pressure. The Fig. 7 holds 20 gallons of water and the Fig. 8 holds 30. Has brass nozzle with numerous small holes. Bowl may be shifted to fit desired location. The sprayer is suitable for either steam or hot water and may be purchased separately.

COMPLETE $55.00

WARCO Hydraulic Steamers



The Fig. 9 and Fig. 4 WARCO Steamers are each equipt with Copper WARCO Boiler, all brass fittings, double acting Hydraulic Pump with inside parts made of brass and bronze to insure long life.

←GAS BURNER HOOK-UP IF DESIRED

Notice the new high power Perfection Stove on the Fig. 4 and the Giant Perfection Stove on the Fig. 9.

FIG. 4 COMPLETE $50.00
FIG. 9 COMPLETE $55.00

ALL QUOTATIONS ARE F.O.B. BUCYRUS, OHIO
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of definitely better flavor & aroma-producing qualities.

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Provalac supplies the thoroughly palatable, fruit and vegetable form of vitamin A activity. It is available at nominal cost—no royalties or license fees to pay. No extra equipment to buy.

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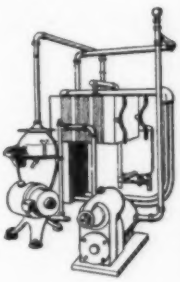
DIVERSEY DAIRY DATA

Published by **THE DIVERSEY CORPORATION**
53 W. Jackson Blvd., Chicago, Ill.

New Diversey Discovery Solves Complex Milkstone Problem for Dairy Plants

Cuts Cost of Cleaning Heat Exchange Unit One-Third; Does Far Better Job

How a Diversey D-Man successfully cleaned a ——— plate type heat exchange unit handling 70,000 lbs. of milk daily and cut former cleaning costs one-third is a tribute to the efficiency of a new milkstone remover recently developed in the Diversey Research Laboratory.



Within the past few years this new type of pasteurizing equipment has become increasingly popular . . . and with it have come new cleaning problems. During the time that the milk is heated and cooled, a tremendous volume passes over a comparatively small area of equipment. Furthermore, this short-time pasteurization requires the application of higher temperatures than usual (160–165°F.). Because of these two factors, milkstone problems have been created which, until but a few months ago, remained an unanswered challenge to the ingenuity of all cleaner manufacturers.

Diversey Chemists Tackle Problem

Diversey chemists tackled the problem by first analyzing the type of milkstone produced under these radically different conditions. They found that two basically different types of material were present in the contamination and formed in such a way that even the complete removal of one component would not permit satisfactory removal of the other by brushing.

With this knowledge, however, Diversey chemists developed a new product (Diversey Dilac) which partially dissolved the milkstone and so decomposed it that subsequent treatment with a second Diversey product, followed by a slight brushing, successfully completed the job. This new Diversey Combination Method gave results heretofore unobtainable with any product, or, for that matter, any combination of products. Today, it is possible to keep plate-type units, even when used for handling vast quantities of milk in short-time pasteurization, in perfect sanitary condition with a minimum of time, labor and material.

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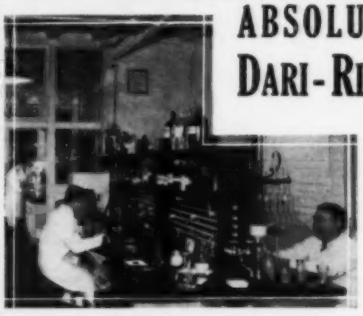

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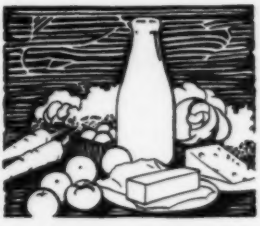

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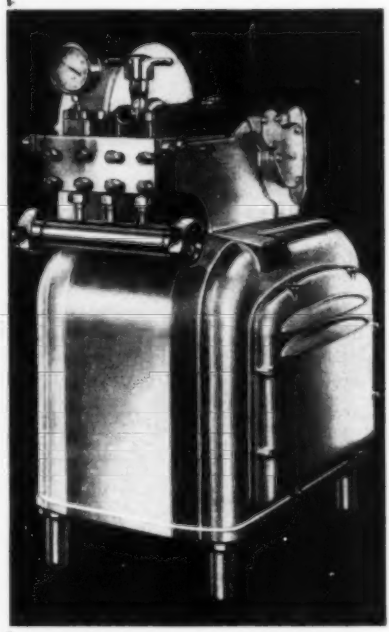

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